Practical Computing

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80p April 1983 Volume 6 Issue 4

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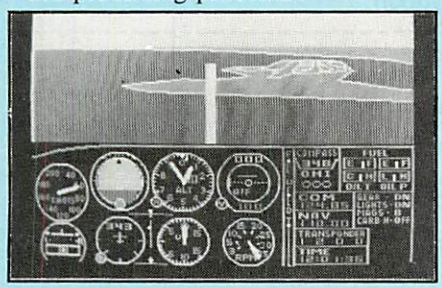

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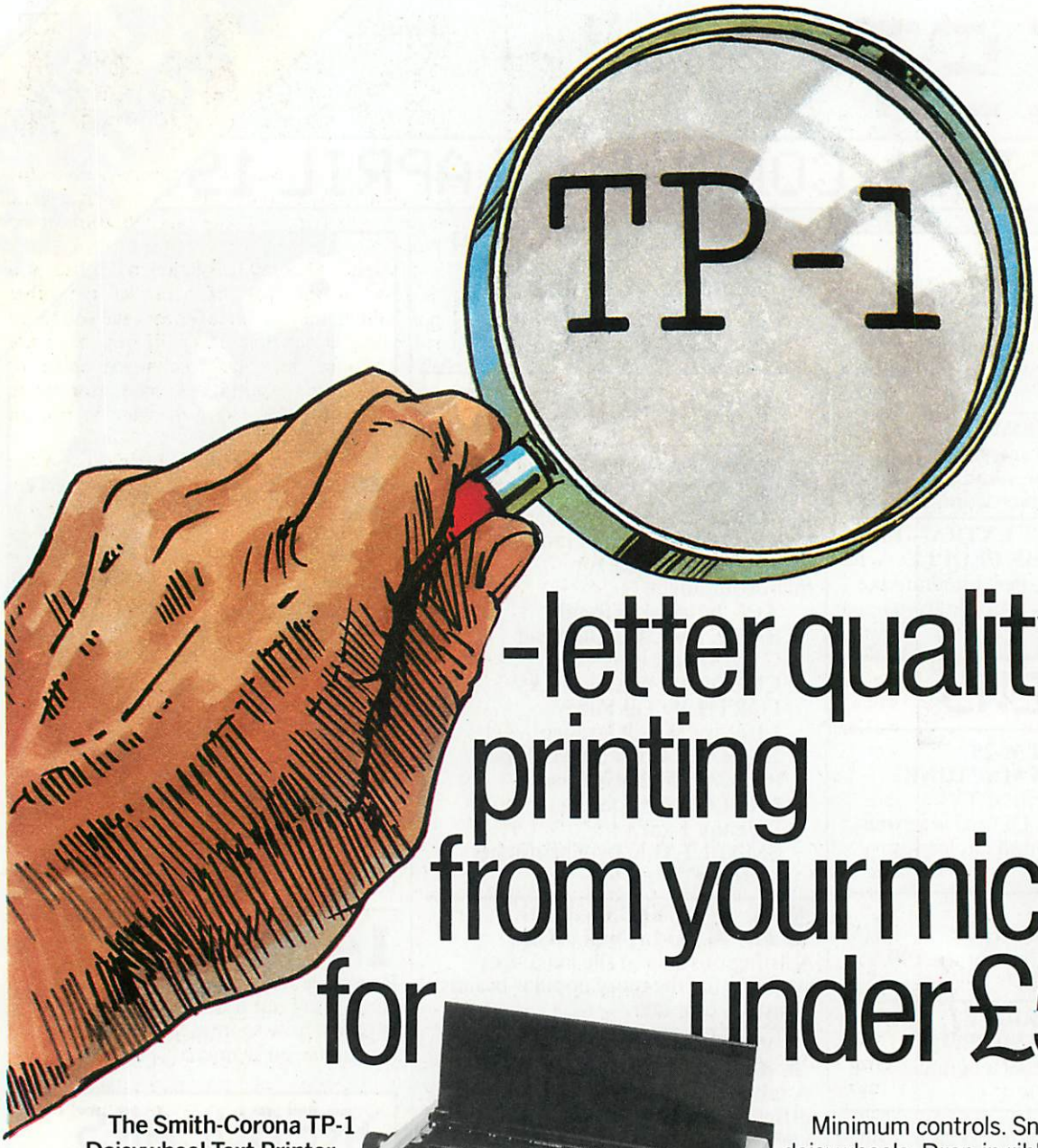

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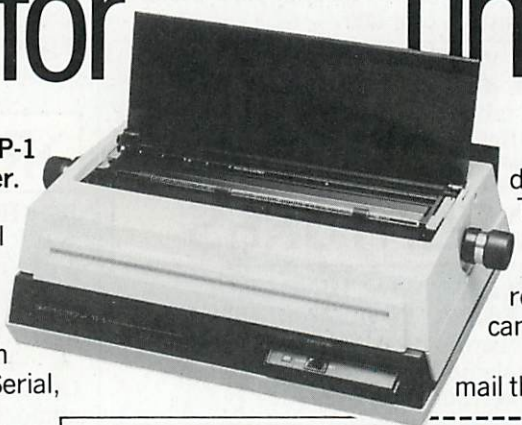

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Would-be authors are welcome to send articles to the Editor but *PC* cannot undertake to return them. Payment is at £30 per published page. Submissions should be typed or computer-printed across a 40-character width, and include a tape or disc of the program. Handwritten material is liable to delay and error.
Every effort is made to check articles and listings but *PC* cannot guarantee that programs will run and can accept no responsibility for any errors.

Basic Babel

LANGUAGES are a problem. To begin with there are those broad categories of computer users who all seem to use different languages for their particular interests. To use the crudest generalisation, the business software writers are writing Cobol, the scientists are using Fortran, the educationalists are using Pascal and the hobbyists are using Basic. Contact between the groups only occasionally degenerates to the "Basic programming causes brain damage" level, but rarely rises above open indifference. This is unfortunate, because surely the knowledge of another language must illuminate one's own.

In the personal computer field covered by *Practical Computing,* Basic has become the *lingua franca,* but even here there are problems. Like Britain and America in the famous quotation, Basic users are separated by the barrier of a common language.

The American National Standards Institute has a committee working on a standard Basic and while this is laudable enough, the practical value will be limited. Even if every micro manufacturer were to embrace ANSI Basic there would still be large amounts of machine-specific coding in most worthwhile programs. Most personal computers seem to do their best tricks in response to obscure Pokes and Calls — and the cheaper the micro, the more this seems to be the case.

The result is that Basic programs written for one machine become unreadable to many of those people who own and use another.

Unfortunately few beginners will even bother to read an article which features, say, a Pet program if they happen to own, say, a Spectrum. This is unfortunate for them, as they might well learn something useful from the structure of the program and the algorithms used. They might even see how they could rapidly translate it for their own machine. But unfortunately for us, they may turn instead to a magazine that concentrates on their machine exclusively.

This raises the horrifying prospect of 350 different microcomputer magazines catering for the obscure preferences of the owners of the different brands, and no one talking to anyone else. In sum, the collapse of civilisation as we know it.

The special Languages section in this issue will at least inform you of some of the other possibilities and, we hope, encourage you to try something other than Basic, if you have not already done so. The comparison table of different Basics should help with translating programs written for one machine to run on another.

Another possibility is being explored in the Netherlands with NOS-Basicode. Specially written programs, supplied on tape, allow a number of different micros to use programs written in Basicode. Naturally these programs have to be written to somewhat rigorous specifications. But nonetheless, micros covered by the scheme now include the Acorn Atom, Apple, DAI, Pet, Exidy Sorcerer, TRS-80, Ohio Superboard and Philips P-2000.

Because of different graphics capabilities, Basicode only really works with text-based programs, not games. The main advantage of the system is that the original Basicode listing has to be written so simply and logically that just about everyone should be able to read it. Individual users are then left to put back all those "extended" Basic words that Basicode leaves out, and to dress up the display to suit the capabilities of their own micro.

As the power of microcomputers continues to increase, perhaps one day most models will be able to emulate, or imitate, the functions of several others. Until this bright day dawns, we will all have to revert to a form of pidgin-Basic, or else start learning and using other languages to the extent that we can understand what's happening, instead of just pushing buttons marked Goto.

Basicode is sponsored by NOS radio and Radio Netherlands. Enquiries to Hans G Janssen, Hobbyscoop, PO Box 1200, 1200 BE Hilversum, The Netherlands.

5 Years ago...

At present the U.K. boasts something like six companies making home and small business computers based on microprocessors, my own company being one of them.

The Government is considering investing £50 million in a product which has not yet been designed (the 64K RAM) to be made in a factory which has not yet been built. Foreign manufacturers are already beginning to produce prototypes to be made by experienced personnel in existing factories.

Why not invest some of that £50 million in an attempt to stimulate a home market by reducing the prices of the end products? There are several U.K. companies capable of designing better microcomputers than the Americans and with the world-famous U.K. software in them.

As an example we considered buying an American microprocessor development system for £365; in fact we designed our own with improved hardware, better interface facilities and much-improved software. It sells for £155, less than half of the American equivalent. A fall in component prices of about 25 percent helped but, even so, we could have done it for about half the cost of any equivalent American design.

Apply this philosophy to our $2,000 product and it would end up at about £700, and a simple home computer such as those currently selling at £500-£700, could be built for £350-£400.

John H Miller-Kirkpatrick,
Technical Director, Bywood Electronics.
Practical Computing Volume 1 Issue 2

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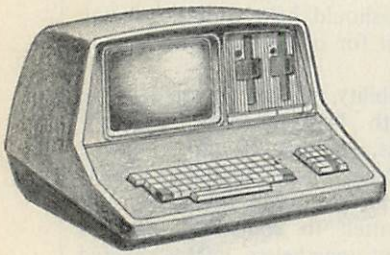

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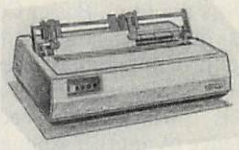

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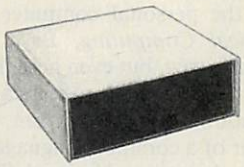

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British micro business

I AM IN THE MICROCOMPUTER BUSINESS buying and selling hardware and software. The British market is an interesting one as a lot of inventions and developments are made in Britain. But one thing worries me: communications and reliability are not of the same high level as the products.

What I mean is, the mail service is slow, slow, slow. When I write a letter it takes at least three weeks to receive an answer. Could it be that letters are not answered though they are already in the office? Are there not enough people who would be happy to be employed?

Even a three-week wait might be acceptable if the answer ever arrived! But it has often happened to me that enquiries are not answered at all. Is business going so well? Too well? Others have promised to send goods, and then nothing arrives. I have been waiting for some items for more than one year.

Perhaps I should not trade with Britain at all. Yet I am still convinced that good products can be made in the EEC and need not come from the Far East. Britain is renowned for its top-class electronics. British companies producing for the lower end of the market should jump at the opportunities open to them in Germany.

Joachim Müller,
Müller Mikrocomputer Mainz,
Postfach 42 10 12,
6500 Mainz 42,
West Germany.

● **It is probably no consolation to Herr Müller to know that enquiries from U.K. users get exactly the same treatment.**

Grid compass

YOUR ARTICLE on portables in the January issue stated that the Grid Systems Compass Computer "was designed by U.K.-based Moggridge Associates" and gave the prices "just over £8,000" which is rather misleading. This computer was designed at our California office ID Two, and is only being marketed in the U.S. at present. The price is around $8,000 — dollars not pounds!

Rosamary Lees
Moggridge Associates,
London NW5

Help with writing

I HOPE one of your readers will be able to help with advice, references, etc. Our youngest daughter is nearly seven and suffers from some brain damage. She is able to recognise letters and read simple words but her writing is held up by her inability to use a pen.

Microcomputers have been put forward as an answer, and she has shown that she enjoys using the keyboard on the Speak'n'Spell. We have a 48K Spectrum at home and I have access to the ITT version of the Apple with disc drives, including DOS 3.3. I would be grateful to hear from anybody who has experienced these difficulties.

Dr K B J Beswick,
Lime Tree House,
High Street,
Harwell,
Oxfordshire.

Microwriter

I WAS VERY SURPRISED to see no mention of the Microwriter in the review of word processing in the February issue, even though you had a special section on unusual keyboards. As an enthusiastic user of the Microwriter I can tell you that the six-key layout of the machine is by far the easiest to use of all the keyboards and will of course communicate with any computer which has an RS-232 interface.

Using a computer would be a great deal easier if other manufacturers could be persuaded to adopt the same layout. May I suggest you do a feature on the Microwriter, which is a unique pocket-sized fully portable word processor. Once you have one it is difficult to imagine working without it. One of these days I shall get around to transmitting my copy to the printer direct into setting over the telephone.

Peter Dean,
Brussels,
Belgium.

● **Like the product, don't like the price.**

A4 stationery

FOR SOME TIME I have been trying to source a supply of A4 continuous stationery for my word-processing requirements. It was with great interest therefore that I read the comments in your December news entitled "Letter Stationery", which clearly states that Moore Paragon supplies neat A4-size Kleen Edge sheets of paper.

Upon examination and indeed discussion with Moore Paragon, it transpires that it is not A4 but 11in. or 12in. stationery. This is therefore quite clearly a misinterpretation of the facts and I would ask you to take Moore Paragon to task for misleading your readers in this manner.

I would be grateful if you could advise whether the internationally accepted A4 standard could be obtained in continuous preprinted form.

Garrick S Wales,
Stewart Wales Somerville Ltd.,
East Kilbride,
Glasgow.

● **Apologies for our mistake. Moore-Paragon said the paper was A4 *compatible*, which is not the same thing. Does no one supply A4 paper?**

Dragon Pokes

DRAGON OWNERS may be interested in a simple way to overcome the automatic scroll on the computer. It is done by Poking the screen addresses instead of using the Print @ command. The addresses are:

Start — 1024
Finish — 1535

For example, Poke 1024,255 is the same as

PRINT @ 0,CHR£(255)

Using Poke instead of Print also allows inverse spaces as well as inverse characters such as inverse £ @ & ' " / etc., which are not available by using the Shift-0 combination. The program displays all the characters when using Poke. It is useful when using the block graphics from ASCII code to draw mazes, etc.

Dragon Pokes.

```
10 CLS
20 X=1024
30 FOR P=0 TO 255
40 POKE X,P
50 X=X+1 : IF X=1536 THEN
   70
60 NEXT P
70 GOTO 70
```

David West,
Taplow,
Berkshire.

More jargon

AFTER Chris Naylor's A-Z of computing terms in the March issue, here are some further definitions:

Algorhythm Fashionable dance from a planet of the star Algol.
Assembler One who puts together a computer kit.
Burn-in The result of dropping cigarette ends or a hot soldering iron on the computer.
Control-bus Transport for traffic wardens.
Card-reader Fortune teller.
Character buffer Bribe money.
Checksum Total amount paid for a computer.
Chip Light snack during programming.
Cross assembler 1. Manufacturer of souvenirs for places of pilgrimage. 2. Angry citizen of Dundee putting together a computer.
Exor First part of a psycho-thriller film.
Firmware Clothing worn by business people.
Floating point Optical disturbance resulting from extended periods of staring into a monitor.
Garbage collection routine Removal of scraps of paper, notes etc., from the desk after a long programming session.
Handshaking State of someone sitting at a computer for the first time.
Hidden refresh Secret drinking.
Indexed addressing Pointing the direction for someone asking

(continued on page 8)

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback — it is your chance to keep in touch.

(continued from previous page)

the way.

Indirect addressing Writing to a box number.

Interface The place in which the solution of a problem often stares.

Interrupt routine Annoying habit of children/adults when adults/children are discussing computers.

Memory refresh A souvenir of Benidorm.

Nesting Activity of a newlywed programmer.

Packing density Standard measure of the volume of a suitcase.

Refresh logic Argument of a drinker.

Timesharing When two people own one watch between them.

Write enable To give someone pen and paper.

Dave Kurth and Ronald Baumgartner, Busswil, Switzerland.

Software please

WE RECENTLY PURCHASED a Newbrain Model A and have found it to be a very powerful micro. But like all Newbrain owners we are disappointed that no magazine has even given the Newbrain a second look. I know unless you expand it there is not enough memory for much, but could you publish a small program or tell us of any software available?

Richard Nash, Petts Wood, Kent.

● **We like the Newbrain and we are keen to support it. Some programs from readers will appear next month, but more would be welcome.**

Endless tapes

A COMMON COMPLAINT against the use of cassettes for data storage is the need to rewind if previous files or programs are to be reloaded. It is not possible to do this automatically with standard cassette recorders.

A means of overcoming this drawback is provided by the use of an endless cassette, such as the TDK EC3 cassette. The tapes are short, six minutes maximum, making them ideal for use with computers.

There are, of course, snags. The tapes cannot be rewound or run fast forward and they are expensive compared with standard E15 cassettes. These difficulties are offset by the ability to manipulate the cassette solely by software, since the tapes move forward only.

Because of the different operating systems used on micros it is only possible to generalise on the applications of these tapes. However, with proper program organisation it should be possible to develop an efficient file system on tape.

The tapes come into their own for management of databases. I am at present still experimenting with these tapes, but they have already proved invaluable in the manipulation of data and for record purposes. No doubt readers will be able to think up other suitable applications.

M J Bedford, Bradford, West Yorkshire.

Left in the lurch

I DO NOT BELIEVE that the computer industry will ever be taken seriously by the business world if it cannot provide an efficient repair service. I have been waiting over six weeks for my Pet 2001, which is essential for the efficient running of my farming business, to be repaired by one of Commodore's nationwide dealers. The dealer is still waiting for parts.

It seems to me that dealers are more interested in the big profits to be made from selling computer systems than actually providing what the customer wants, and that is a good back-up service. It is interesting to note that of the 18 Commodore dealers listed in your magazine in March 1979 only nine were still in business by October 1982.

Surely Commodore should vet its dealers more thoroughly in order to protect the customer and its own good name; otherwise, being an authorised dealer means nothing.

R H Pring, Crewkerne, Somerset.

● **Since we received Mr Pring's letter the matter was finally resolved through a local Commodore dealer.**

Plea for service

AS AN OWNER of a BBC Micro I must condemn Acorn for a lack of understanding to its customers and would-be customers, for not supplying sufficient telephone answering facilities. To get through to Acorn requires the patience of Job, unlimited time and an understanding boss or family when hogging the telephone. I must have been trying since early December, in order to sort out a problem with my micro, but to no avail.

It does not make sense: with over 3,000,000 out of work more people could be employed to answer customers' queries. If nothing is done, before long the BBC Micro will go the way of other British products and be replaced by competitors from Japan or America.

M C Krockel, Aberdeen.

Gödel and AI

IN THE FEBRUARY issue Boris Allan suggests that Gödel's theorem rules out the possibility of artificial intelligence. I would accept Allan's main thesis that AI is still a long way off, but not his use of Gödel's theorem.

What Gödel showed was that any mathematical system complex enough to include self-reference could not be fully consistent. As stated it applies to mathematical systems: it is an inductive leap to apply it to microelectronic structures. However, if that is taken for granted, all that Gödel's theorem suggests is that if machines become intelligent they can not be fully self-consistent, that is, they must become far more than glorified calculators following rigid functions. That seems to me to be hardly more than a truism.

Gödel's theorem is a masterpiece of formal logic and is of major importance in the fields of mathematics and metamathematics. However, trying to apply it outside its context is beset with pitfalls. One thinks of attempts to support ideas of free will by using Heisenberg's uncertainty principle — which properly only applies to elementary particles. Ironically, it is just this sort of unbridled extrapolation that Allan is arguing is inappropriate when applied to ideas about AI.

J de B Clarkson, Pratts Bottom, Kent.

BORIS ALLAN seems to have let a fallacy creep into his thoughts on AI. He states that Gödel's theorem implies that a machine cannot think about itself and that therefore a machine cannot be truly intelligent. Besides the rather obvious difficulty of saying what true intelligence is — perhaps just "something that most humans have" — the theorem applies equally to human beings.

Of course I can think about myself. I can even imagine of all the synapses clicking away in my

(continued on page 13)

H'MM- IM NOT SURE.... IT LOOKS A BIT COMPLICATED TO ME.
COMPUTASTORE
COMPLICATED? — NOT A BIT OF IT! LOOK, ITS SO SIMPLE..
... EVEN AN ADULT CAN OPERATE IT!
DEMONSTRATION
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When it's time to stop playing games and get down to business...

Unfortunately, many of today's desk top computers are designed with too much emphasis on home use. That's fine, if you want to balance your checkbook, play "space war" or draw pictures. But when you have serious business requirements for a computer, you want one designed specifically for business.

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British micro business

I AM IN THE MICROCOMPUTER BUSINESS buying and selling hardware and software. The British market is an interesting one as a lot of inventions and developments are made in Britain. But one thing worries me: communications and reliability are not of the same high level as the products.

What I mean is, the mail service is slow, slow, slow. When I write a letter it takes at least three weeks to receive an answer. Could it be that letters are not answered though they are already in the office? Are there not enough people who would be happy to be employed?

Even a three-week wait might be acceptable if the answer ever arrived! But it has often happened to me that enquiries are not answered at all. Is business going so well? Too well? Others have promised to send goods, and then nothing arrives. I have been waiting for some items for more than one year.

Perhaps I should not trade with Britain at all. Yet I am still convinced that good products can be made in the EEC and need not come from the Far East. Britain is renowned for its top-class electronics. British companies producing for the lower end of the market should jump at the opportunities open to them in Germany.

Joachim Müller,
Müller Mikrocomputer Mainz,
Postfach 42 10 12,
6500 Mainz 42,
West Germany.

● It is probably no consolation to Herr Müller to know that enquiries from U.K. users get exactly the same treatment.

Grid compass

YOUR ARTICLE on portables in the January issue stated that the Grid Systems Compass Computer "was designed by U.K.-based Moggridge Associates" and gave the prices "just over £8,000" which is rather misleading. This computer was designed at our California office ID Two, and is only being marketed in the U.S. at present. The price is around $8,000 — dollars not pounds!

Rosamary Lees
Moggridge Associates,
London NW5

Help with writing

I HOPE one of your readers will be able to help with advice, references, etc. Our youngest daughter is nearly seven and suffers from some brain damage. She is able to recognise letters and read simple words but her writing is held up by her inability to use a pen.

Microcomputers have been put forward as an answer, and she has shown that she enjoys using the keyboard on the Speak'n'Spell. We have a 48K Spectrum at home and I have access to the ITT version of the Apple with disc drives, including DOS 3.3. I would be grateful to hear from anybody who has experienced these difficulties.

Dr K B J Beswick,
Lime Tree House,
High Street,
Harwell,
Oxfordshire.

Microwriter

I WAS VERY SURPRISED to see no mention of the Microwriter in the review of word processing in the February issue, even though you had a special section on unusual keyboards. As an enthusiastic user of the Microwriter I can tell you that the six-key layout of the machine is by far the easiest to use of all the keyboards and will of course communicate with any computer which has an RS-232 interface.

Using a computer would be a great deal easier if other manufacturers could be persuaded to adopt the same layout. May I suggest you do a feature on the Microwriter, which is a unique pocket-sized fully portable word processor. Once you have one it is difficult to imagine working without it. One of these days I shall get around to transmitting my copy to the printer direct into setting over the telephone.

Peter Dean,
Brussels,
Belgium.

● Like the product, don't like the price.

A4 stationery

FOR SOME TIME I have been trying to source a supply of A4 continuous stationery for my word-processing requirements. It was with great interest therefore that I read the comments in your December news entitled "Letter Stationery", which clearly states that Moore Paragon supplies neat A4-size Kleen Edge sheets of paper.

Upon examination and indeed discussion with Moore Paragon, it transpires that it is not A4 but 11in. or 12in. stationery. This is therefore quite clearly a misinterpretation of the facts and I would ask you to take Moore Paragon to task for misleading your readers in this manner.

I would be grateful if you could advise whether the internationally accepted A4 standard could be obtained in continuous preprinted form.

Garrick S Wales,
Stewart Wales Somerville Ltd.,
East Kilbride,
Glasgow.

● Apologies for our mistake. Moore-Paragon said the paper was A4 *compatible*, which is not the same thing. Does no one supply A4 paper?

Dragon Pokes

DRAGON OWNERS may be interested in a simple way to overcome the automatic scroll on the computer. It is done by Poking the screen addresses instead of using the Print @ command. The addresses are:

Start — 1024
Finish — 1535

For example, Poke 1024,255 is the same as

PRINT @ 0,CHR£(255)

Using Poke instead of Print also allows inverse spaces as well as inverse characters such as inverse £ @ & ' " / etc., which are not available by using the Shift-0 combination. The program displays all the characters when using Poke. It is useful when using the block graphics from ASCII code to draw mazes, etc.

Dragon Pokes.

```
10 CLS
20 X=1024
30 FOR P=0 TO 255
40 POKE X,P
50 X=X+1 : IF X=1536 THEN
   70
60 NEXT P
70 GOTO 70
```

David West,
Taplow,
Berkshire.

More jargon

AFTER Chris Naylor's A-Z of computing terms in the March issue, here are some further definitions:

Algorhythm Fashionable dance from a planet of the star Algol.
Assembler One who puts together a computer kit.
Burn-in The result of dropping cigarette ends or a hot soldering iron on the computer.
Control-bus Transport for traffic wardens.
Card-reader Fortune teller.
Character buffer Bribe money.
Checksum Total amount paid for a computer.
Chip Light snack during programming.
Cross assembler 1. Manufacturer of souvenirs for places of pilgrimage. 2. Angry citizen of Dundee putting together a computer.
Exor First part of a psycho-thriller film.
Firmware Clothing worn by business people.
Floating point Optical disturbance resulting from extended periods of staring into a monitor.
Garbage collection routine Removal of scraps of paper, notes etc., from the desk after a long programming session.
Handshaking State of someone sitting at a computer for the first time.
Hidden refresh Secret drinking.
Indexed addressing Pointing the direction for someone asking

(continued on page 8)

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback — it is your chance to keep in touch.

(continued from previous page)

the way.

Indirect addressing Writing to a box number.

Interface The place in which the solution of a problem often stares.

Interrupt routine Annoying habit of children/adults when adults/children are discussing computers.

Memory refresh A souvenir of Benidorm.

Nesting Activity of a newlywed programmer.

Packing density Standard measure of the volume of a suitcase.

Refresh logic Argument of a drinker.

Timesharing When two people own one watch between them.

Write enable To give someone pen and paper.

Dave Kurth and Ronald Baumgartner, Busswil, Switzerland.

Software please

WE RECENTLY PURCHASED a Newbrain Model A and have found it to be a very powerful micro. But like all Newbrain owners we are disappointed that no magazine has even given the Newbrain a second look. I know unless you expand it there is not enough memory for much, but could you publish a small program or tell us of any software available?

Richard Nash, Petts Wood, Kent.

● **We like the Newbrain and we are keen to support it. Some programs from readers will appear next month, but more would be welcome.**

Endless tapes

A COMMON COMPLAINT against the use of cassettes for data storage is the need to rewind if previous files or programs are to be reloaded. It is not possible to do this automatically with standard cassette recorders.

A means of overcoming this drawback is provided by the use of an endless cassette, such as the TDK EC3 cassette. The tapes are short, six minutes maximum, making them ideal for use with computers.

There are, of course, snags. The tapes cannot be rewound or run fast forward and they are expensive compared with standard E15 cassettes. These difficulties are offset by the ability to manipulate the cassette solely by software, since the tapes move forward only.

Because of the different operating systems used on micros it is only possible to generalise on the applications of these tapes. However, with proper program organisation it should be possible to develop an efficient file system on tape.

The tapes come into their own for management of databases. I am at present still experimenting with these tapes, but they have already proved invaluable in the manipulation of data and for record purposes. No doubt readers will be able to think up other suitable applications.

M J Bedford, Bradford, West Yorkshire.

Left in the lurch

I DO NOT BELIEVE that the computer industry will ever be taken seriously by the business world if it cannot provide an efficient repair service. I have been waiting over six weeks for my Pet 2001, which is essential for the efficient running of my farming business, to be repaired by one of Commodore's nationwide dealers. The dealer is still waiting for parts.

It seems to me that dealers are more interested in the big profits to be made from selling computer systems than actually providing what the customer wants, and that is a good back-up service. It is interesting to note that of the 18 Commodore dealers listed in your magazine in March 1979 only nine were still in business by October 1982.

Surely Commodore should vet its dealers more thoroughly in order to protect the customer and its own good name; otherwise, being an authorised dealer means nothing.

R H Pring, Crewkerne, Somerset.

● **Since we received Mr Pring's letter the matter was finally resolved through a local Commodore dealer.**

Plea for service

AS AN OWNER of a BBC Micro I must condemn Acorn for a lack of understanding to its customers and would-be customers, for not supplying sufficient telephone answering facilities. To get through to Acorn requires the patience of Job, unlimited time and an understanding boss or family when hogging the telephone. I must have been trying since early December, in order to sort out a problem with my micro, but to no avail.

It does not make sense: with over 3,000,000 out of work more people could be employed to answer customers' queries. If nothing is done, before long the BBC Micro will go the way of other British products and be replaced by competitors from Japan or America.

M C Krockel, Aberdeen.

Gödel and AI

IN THE FEBRUARY issue Boris Allan suggests that Gödel's theorem rules out the possibility of artificial intelligence. I would accept Allan's main thesis that AI is still a long way off, but not his use of Gödel's theorem.

What Gödel showed was that any mathematical system complex enough to include self-reference could not be fully consistent. As stated it applies to mathematical systems: it is an inductive leap to apply it to microelectronic structures. However, if that is taken for granted, all that Gödel's theorem suggests is that if machines become intelligent they can not be fully self-consistent, that is, they must become far more than glorified calculators following rigid functions. That seems to me to be hardly more than a truism.

Gödel's theorem is a masterpiece of formal logic and is of major importance in the fields of mathematics and metamathematics. However, trying to apply it outside its context is beset with pitfalls. One thinks of attempts to support ideas of free will by using Heisenberg's uncertainty principle — which properly only applies to elementary particles. Ironically, it is just this sort of unbridled extrapolation that Allan is arguing is inappropriate when applied to ideas about AI.

J de B Clarkson, Pratts Bottom, Kent.

BORIS ALLAN seems to have let a fallacy creep into his thoughts on AI. He states that Gödel's theorem implies that a machine cannot think about itself and that therefore a machine cannot be truly intelligent. Besides the rather obvious difficulty of saying what true intelligence is — perhaps just "something that most humans have" — the theorem applies equally to human beings.

Of course I can think about myself. I can even imagine of all the synapses clicking away in my

(continued on page 13)

H'MM- IM NOT SURE.... IT LOOKS A BIT COMPLICATED TO ME.
COMPUTAS ORE
COMPLICATED? — NOT A BIT OF IT! LOOK, IT'S SO SIMPLE..
... EVEN AN ADULT CAN OPERATE IT!
DEMONSTRATION
MIKE HALL

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WORKSTATIONS (up to 4)
Keyboard: Ergonomic, low-profile, 83 keys, 10 programmable function keys, 10-key numeric keypad (with cursor/editing functions)
Color Display: High-resolution, 80 characters x 25 lines, upper and lower case, 8 programmable foreground/background colors
Printer: Bidirectional, 80 characters-per-second, friction and tractor feed

SOFTWARE
Operating System: User-friendly, multi-tasking, CP/M, MP/M, PC-DOS compatible
Languages: BASIC, COBOL, Pascal
Applications: Spreadsheet, Database, Text Processing Communications

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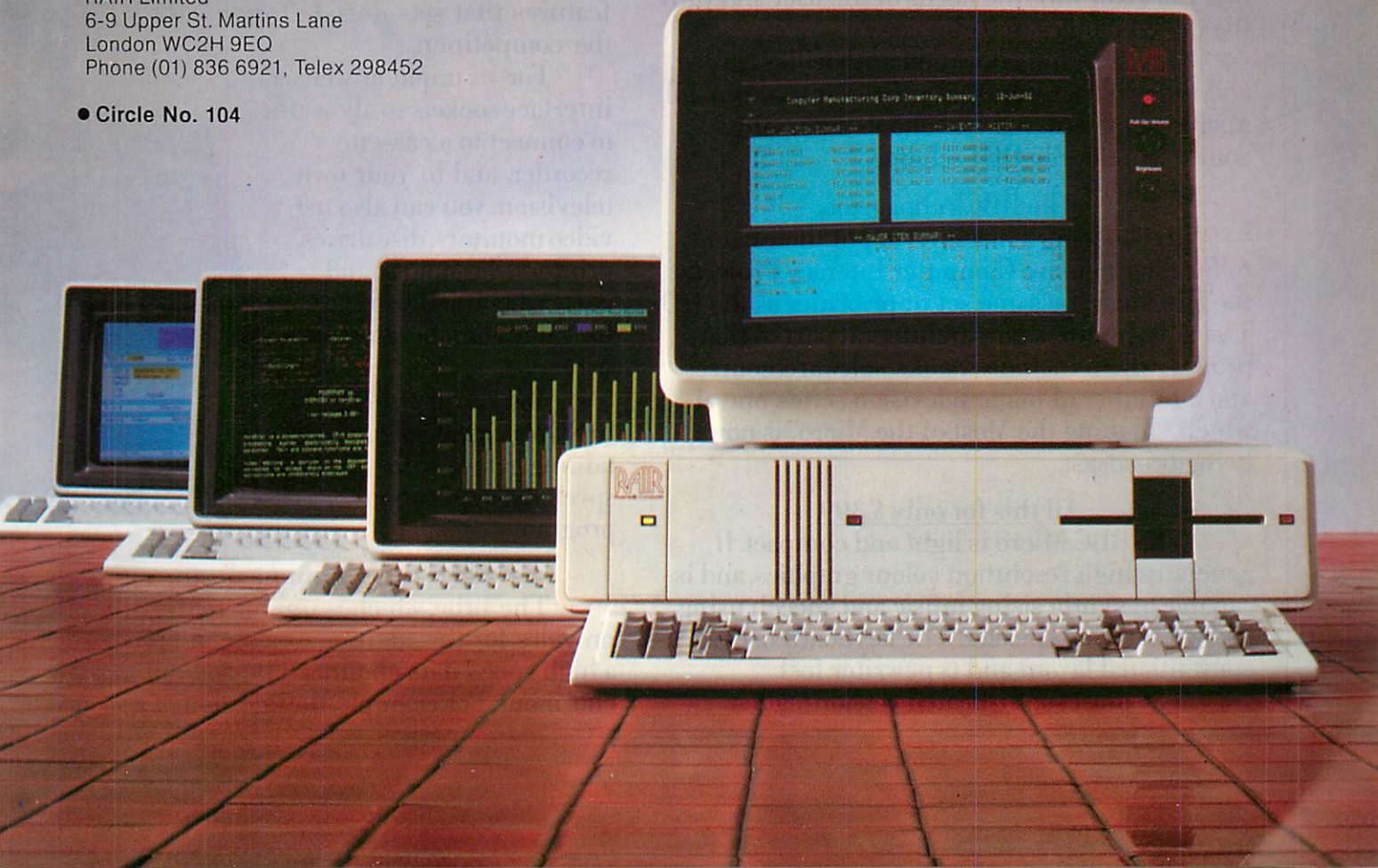


Three out of every four computers going into schools are BBC Micros. Is there a lesson to be learned by every user?

As part of the current government subsidised scheme aimed at introducing micros to schools, the Department of Industry undertook a survey of machines available and made recommendations to education authorities all over the country.

The BBC Micro met their priorities exactly: it is economical yet fast and powerful, and it can justify the investment involved, through its capability to grow with the needs of the user and with the rapid changes in technology.

Teachers and education authorities agreed, and today it represents over three-quarters of all micros being ordered for schools across the country under the DOI scheme.

The BBC's choice too.

In choosing a machine to put their name to for their massive Computer Literacy Project, the BBC had the same set of priorities as the DOI. The BBC Micro is now an integral part of that project, which includes books, software, courses and a number of major television series, one of which, "Making the Most of the Micro" is now being broadcast.

All this for only £399.

The BBC Micro is light and compact. It generates high resolution colour graphics, and is capable of synthesising music and speech using its own internal speaker. The keyboard uses a conventional layout and typewriter feel.

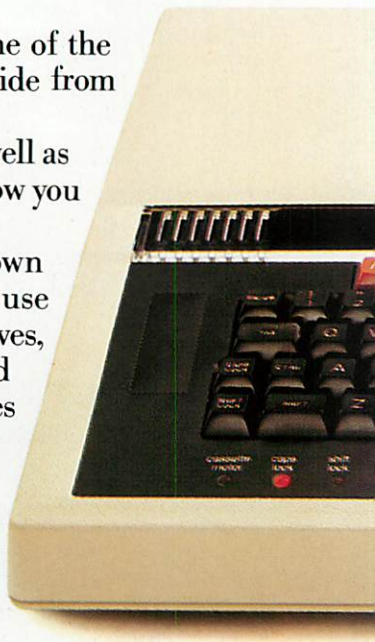
The most sophisticated version (called Model B) is available for only £399. (There is also a basic model available, the Model A, at £299.)

Designed to grow.

Last year the magazine "Which Micro?" said that the most attractive and exciting feature of the BBC Microcomputer was its 'enormous potential for expansion'.

This is indeed one of the features that sets it aside from the competition.

For example, as well as interface sockets to allow you to connect to a cassette recorder, and to your own television, you can also use video monitors, disc drives, printers (dot matrix and daisy wheel) and paddles for games or laboratory use.



You can also plug in ROM cartridges containing games with specialist application programs.

The Tube. A unique feature.

The Tube, which is unique to the BBC Micro, provides for the addition of a second processor via a high speed data channel. The possibilities are enormous. For example, the addition of a second

3MHz 6502 processor with 64K of RAM doubles processing speed. While a Z80 with 64K of RAM opens the door to a fully CP/M* compatible operating system, with all the benefits for business applications.

Linking up with other computers.

The BBC Micro also offers a facility of immense potential value to schools, colleges and businesses. It's called Econet® – a system which uses telephone cable to link with other BBC Micros. A number of machines can then share the use of expensive disc drive and printer facilities.

Make full use of Prestel & Teletext.

With special adaptors you will not only be able to turn your TV set into a Prestel terminal and Teletext receiver, but you can also take data and programs direct from these services. (The programs, which are known as telesoftware, are already being broadcast by BBC's Ceefax service.) This is another first for the BBC Micro.

BASIC plus.

A sophisticated version of BASIC has been chosen for the BBC Micro, which incorporates features normally found only in more advanced high level languages. However, there is also a facility allowing access through a simple command to another language – for example, PASCAL, FORTH and LISP.

*Trademark of Digital Research.

A full range of software.

Applications software for the BBC Micro already cover a very wide field. Packages covering games, education and business applications are available on cassette. All developed to the same high standards set by the hardware.

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Alternatively, you can buy a Model B directly by sending off the order form below to: BBC Microcomputers, c/o Vector Marketing, Denington Estate, Wellingborough, Northants, NN8 2RL.

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brain or ponder what I was thinking about this morning. I would expect any "truly intelligent" machine to do this about itself. Gödel's theorem does not stop either of us, but rather it stops both of us from thinking about "what I am thinking about now."

Peter Kanssen,
Queen Mary College,
London.

Income tax

I AM WRITING concerning the Payroll program featured on page 148 of the April 1982 issue. I do not claim to be an expert at programming — though I do perhaps know something of income tax, having been in the business for 18 years — but it seems to me that the subroutine 7000 referred to near the top of page 150 is unnecessarily complicated by the use of arrays.

This routine, which should take up less memory space, will cope with codes of unlimited size.

John Doe,
Reigate,
Surrey.

Pet characters

IN A LETTER in the July 1982 *Practical Computing* I described the unusual behaviour of shifted characters in Rem statements on a 4016 Pet. Recently I have discovered an even weirder behaviour of shifted characters anywhere in the program.

This behaviour works in either character set, but as capitals are easier to write than graphics I shall write as if the alternate character set is being used. Enter:

```
10 gO
20 sA
30 rU
40 lO
50 li
```

and then list the program. The computer displays:

```
10 goto
20 save
30 run
40 load
50 list
```

This program is obvious nonsense and is used only to illustrate the point, but these half-shifted abbreviations are accepted by the computer just like the corresponding Basic word. A little research shows that there is a simple way to abbreviate any Basic word.

Income tax.

```
7000 F=0: IF T<1 GO TO 7100
7010 L=INT (T/360+1)
7020 L=INT (T/L)
7030 K=T-INT (T/L)*L
7040 FOR M=1 TO INT (T/L)
   - K:GO SUB 8000 : NEXT M
7050 IF K=0 GO TO 7080
7060 L=L+1
7070 FOR M=1 TO K : GO
   SUB 8000 : NEXT M
7080 NN=N : IF E(J,4)=1
   THEN NN=1
7090 F=F * NN
7100 RETURN
8000 F=F+INT ((((L*
   10+9)/52 * 10   4)
   /10   4+0.049) *20) /20 :
   RETURN
```

There are a few exceptions to this rule:

- two-letter words cannot be formed. tO does not give to.
- pR gives Print #, so ? must be used for Print.
- I can find no way to produce certain words such as gosub, and input. iN gives input #.

Also, if two letters are used that are not the start of any word then the shifted letter is ignored:

```
10 zQ : sS
```

gives

```
10 Z : s
```

I can think of no reason for this to happen. Its practical use is obvious: almost any Basic word can be entered with just two key presses.

R J Dowling,
King's Lynn,
Norfolk.

Unfair to Ace

BORIS ALLAN does less than justice to the Ace computer — Forth thoughts, *Practical Computing,* January 1983. There is no need to define a special word to allow another word to refer to itself: recursion is already part of the Ace repertoire.

Further, Allan's program crashed on all three machines because a signed two-byte number cannot exceed 32,767. The eighth factorial is 40,320.

Peter Davis,
London N3.

Foolish remarks

BORIS ALLAN may think that it is easy to learn some computing, but surely I am not alone in being infuriated by his articles in *Practical Computing* — they imply crass ignorance of most of the subjects he is writing on. In his latest article, in Last Word — I wish it were — he puts forward some rather foolish remarks about artificial

(continued on page 16)

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formulate/recall on selection criteria
12 interrogation question types
short filing output/audit trails

ONE OF THOUSANDS OF DIFFERENT TASKS ON WHICH THIS PROGRAM MIGHT BE EMPLOYED

DMS'S MACROS WORK FROM THE MOMENT YOU INSERT THE 'TASK DISK' IN THE COMPUTER'S DRIVE

Simply design your file, give its fields your words, setup your report mask, and then enter your records. Switch to 'automatic drive' and formulate any task you wish the program to fulfill, the task is stored as a macro. Take a copy of the program on another 'task disk' and from then on, the task disk will function without a single key-stroke. Think of a number of such 'task disks' such as "stock-re-order reports"; "stock-valuation reports"; "sale-mail-shots"; "production-process-analysis"; "patient history analysis"; "research-analysis"; "budgetting" "purchase/sales-analysis"; "personell-file-analysis"; "vehicle-location control"; "librarian analysis"; "plus more?"

Previous issues showed examples of 'employees-short-list', 'garage stock re-order', 'sales analysis' 'librarian's list' 'hospital's patient list' here is an example of a 'rental recording file' and some reports it might generate.

The record may look like this:
1-record number (413)
2-client (Radio cars ltd)
3-date of contract (01.04.81)
4-date last pmt (12.02.82)
5-period/frequency (36 / monthly)
7-amount of pmt (22.50)
8-item type (Taxi-phones)
9-repairs made (faulty microphone — item replaced)
10 cross reference (3.422!C details of full system spec and supplier)

One report might be: select ?? all records where the amount of payments are less than 50 pounds, that were taxi-phones and faults were detected. When found, pick up the cross reference code and look up that record to identify the supplier.

Another report might be: select ?? all records in the file where the commencing date of rental was 04.81 and the term was greater than 12 months. Print a list of all those records where the date last payment was prior to (ie smaller than) 03.82 and prepare a short address file for 'reminders'.

DBMS II (WITHOUT MACROS) AND DBMS III ARE FULLY IMPLEMENTED UNDER CPM-86 (tm) and MS-DOS (tm) ie: (SIRIUS/VICTOR/IBM)
DBMS II IS 395.00 (or 250.00 by mail order ex. training). DBMS III is 575.00 (or 295.00 by mail order ex. training)

TELEPHONES: 01-636 8210 : 01-631 4818 : TLX: 892031 TWCG (BOSTON 94-0890)

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G.W.L.	-G80 64K/interface ports/k'board	895.00
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	-Superbrain 64K RAM/1.5M disks	2595.00
	-Superbrain 64K RAM/10MG disks	call
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	-Compustar 64K RAM/320K disks	1995.00
	-Compustar 64K RAM/700K disks	2495.00
	-Compustar 64K RAM/1.5M disks	2895.00
NORTHSTAR	-Advantage 64K RAM/700K disks	£2195.00
(exc DOS)	-Advantage 64K RAM/5.3M disks	£3095.00
TELEVIDEO	-802 64K RAM/700K disks	2195.00
	-802H 64K RAM/7.3M disks	3750.00
	-806 64K RAM/10M disks	4995.00
	-816 256K/750K disks	£3150.00
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	-Sirius 2 128K/2.4M disks	£2895.00
-Sirius 3 128K/10MEG disks		£3995.00
VICTOR	-9000 128K/1.2M disks	£2395.00
IBM	-PC 64K RAM/640K disks	£2795.00
	-PC1 330K/640K disks	£3395.00
ALTOS	ACS800-2 64K RAM/1M disks	1995.00
	ACS800-10 208K/10.5Meg disks	5495.00
NEC	APC 128K.RAM/2M disks	call.00
CORVUS	Concept 16 bit pc	call.00
SANYO	G80 64K RAM/320K disks	1195.00
	G81 64K. RAM Networker	1350.00
ABC	24 64K RAM/700K disks	2195.00
	26 64K RAM/2.2M disks	3250.00

All computer prices include mbasic as standard.
All prices marked £ are 8/16 bit machines.

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add 110.00 for delivery & installation (optional)
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mbasic 80	diagnostics	msort/dsort
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****total value 1525.00****

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RICOH	-RP1600	1495.00
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GIX	Port expander (switcher)	95.00

NOTE: Corvus drives with multiplexor may network sirius .. Superbrain .. Concept .. PET .. Victor .. IBM

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G.W.L.	-BUS V8.00 (Accounts)	275.00
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MICROSTUFF	-Cross-talk (Tele-comms')	95.00
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Software formats on all micros in our hardware list.
All prices marked £ are available 8/16 bit formats.

TERMS & ETC

G. W. Computers Ltd (Grama (Winter) Ltd)
55 Bedford Court Mansions
Bedford Avenue
London W.C.1. England.
Tel: 01-636 8210: 01-631 4818: tlx 892031 twc g
Boston office tlx 94-0890
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FORMS/TEXT/CALC/DBMS IV

Contains the highest state of the art software available today

ALL IN ONE PROGRAM

When you budget for a complete system of software you eventually end up with a host of packages like, Sales, Purchases, Nominal, Data, Text, Calc, Mailshot, Invoice, Order, Workflow, Personnel, and so on.
The list is endless and the outlay several thousands of pounds.

DBMS IV

Has most of the features you need from the above list in one program!!!!.

Features.	Design a form as wide as a window of 250 characters, long as needed. Cursor movements are 'left, right, up, down, delete left delete right, tab right-left-up-down' Paint your form as you like directly on the screen.
Text.....	Write a letter as you see it on the screen, edit it then simply enter ^P to print.
Calc.....	Set into the form, your data fields, ''£££££'' and specific file-related activities, formulae and validation checks. Enter values and see the spreadsheet calculate itself.
Database.	Search files for data to be inserted to fields specified. All the features of DBMS III, explained elsewhere in our ad.

Here's an example of an invoice you might design for your stationery .....
You could design your own spreadsheet, order form, statement, or any other kind of form that is required to fit your existing stationery.

<0>£££££££££££

INVOICE

To £<1>£££££££££££
£<2>£££££££££££££££
£<3>£££££££££££££££
£<4>£££££££££££
£<5>£££££

From: G.W. Ltd
55 Bedford Court Mans.
Bedford Avenue
London W.C.1.
Tel: 01-636 8210

Date <6>£.£ Tax point <7>£.£ Agent <8>£££

Quantity	Description	Cost	Tax	Total
<9>£££	<10>£££££££££££	<11>£	£	<12>£
<14>£	<15>£££££££££££	<16>£	<17>£	
< 1	8 >	£	£	£

and so on .....

Total.....<19>£££££ Tax.....<20>£££

<??>	items <1>to <5>internal command to request name input, and then search an address file for details.
<??>	items <6>to <7>request date input and validate.
<??>	item <8>request agent number and validate range.
<??>	<9>request quantity, validate range.
<??>	<10>request description, search file, accept, and calculate fields <11>, <12>, <13>, if finished invoice then calculate fields <19> and <20>

Now comes the more valuable facility, you can provide the 'FORM' with file-related instructions, not only to request a 'console' input for a file search against names, and stock, but after the invoice is finished the fields you have selected may be passed to related files.

EG: Send fields <0>, <1>, <6>, <7>, <11>, <12>, <13>, <19>, <20> to a sales ledger.
Then send fields <9>, <10>, <11>, to product analysis file.
Then send fields <0>, <1>, <7>, <19>, <20> to V.A.T. file
Then send fields <10>, <11>, <12>, <13> to Nominal ledger.

The program is only available from G.W. Computers Ltd <U.K.> with a system purchase at 575.00, note DBMS III comes free with system deals. or by mail order transaction at 395.00

● Circle No. 108

PORTABLE COMPUTERS

EPSON HX/20 (Brief case Computer. Weighs less than 4lb. 16K expandable to 64K. Full size ASCII keyboard. Runs on own power for 50 hours. Complete with serial and RS 232/Interface. **£400.00**

Add on fac. inc. Barcode. Reader/ Microcassette/Acoustic Couplers for telephone link up etc.

HP75C (The new portable computer 16K expandable to 48K size just larger than a reporters notebook, weighs under 2lb). Will inface with other HP equipment incl. •Items detailed below ideal for Eng./Sci/ travelling business executive. (600 appointments can be stored in Mem built in international clock full size keyboard etc). **£600.00**

Turn your 41C/CV System into a hand-held Computer with these accessories

•**Portable Digital Cassette Drive** (stores up to 131,072 bytes on a moveable mini date cassette. Files can be given "Meaningful" names. Average file access 13 secs. works on rechargeable batteries and is completely portable) **£310.00**

•**HP 7470A 2 pen plotter** With plotter module first-time users can quickly generate line graphs/bar charts/overhead slides etc. Allows rapid generation of bar code commands. **£950.00**
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Extended function and memory modules for HP41C/CV now in stock. Adds approx. 4K Mem storage.

HP41C £120.00
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Printer 82143A **£220.95**

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HP Wand **£76.00**
HP1L Module **£78.00**
HP16C **£93.00**

In stock HP10C 11C 15C/1. Tel. for prices.

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HP41CV together with card reader and printer (82143A). All complete as manufacturers spec. **£500.00**

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Prices and Literature on request

SHARP

PC 1500 Pocket Computer	£130.00	cables, CP/M operating system and	
CE 158 RS232 and Cent I/F	£130.00	Sharp Disc BASIC & Manual	£650.00
CE 15A Appli Tape	£13.00	MZ-80FB Dual Floppy Disc Drives for	
CE 150 4 printer/cassette I/F	£115	MZ-80B complete with I/F card,	
CE 151 4K Add on mem	£43.00	cables, CP/M operating system and	
CE 152 Cassette	£34.00	Sharp Disc BASIC & Manual	£650.00
CE 153 Add on Soft Card	£69	MZ-80P4 150 cps Matrix Printer	£700.00
CE 155 8K Add on mem	£69.00	MZ-80P5 80 cps Matrix T/F Printer	£360.00
MZ-80A 48K Computer	£425.00	MZ-80P6 80 cps T/F F Printer	£400.00
MZ-8080AEU Exp Unit for	£86.00		
MZ-80FB Dual Floppy Disc Drives for MZ-80A complete with I/F card,			

The SHARP MZ-80 P4, P5 and P6 PRINTERS come complete with interface card, printer cable and ROM.

SPECIAL OFFER
TEXAS T159 together with PC100C (Complete as manufacturers specifications) **£265.00**

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● **Circle No. 109**

(continued from page 13)

intelligence, such as how it is not really intelligent.

If computers can never be intelligent then what makes him think that people are intelligent? Definititions of intelligence are notoriously difficult, but the trend in the past has been for computers to do more and more things that previously people would have said required intelligence. I see no reason for this trend to stop.

John Kleeman,
London NW3.

● **Last Word next month will be written by a computer.**

Some welcome!

AFTER TWO DAYS and a dozen temperamental attempts to load the BBC Welcome tape, as a last resort I changed over the Mic/Record jack plugs and all was then splendid. So be warned, if the jacks are the wrong way round, the screen may not show blank or rubbish.

It is like the navy pilot who took off not noticing that the wings of his plane were folded, and flew safely.

M Schaffer,
Haywards Heath,
West Sussex.

Alphabetical Sinclairs

I WAS PLEASED to see that you were able to publish my program in the January issue of your excellent magazine — page 115. Unfortunately, there were two small errors. Two lines should be inserted as follows:

1105 LET C(P) = C(P + 1)
1170 LET L (P) = 0

Various line numbers referred to in my explanation of the program related to an early version, rather than the later improved version which you printed. The corrected numbers are as follows:

For	13	read	40
	15		60
	17		80
	19		100
	21		120
	132		1200
	134		1220
	135		1230
	150		1370
	151		1380

The program will, of course, run without any alterations on the Spectrum, which I now use.

John Loncaster,
Hornsea,
Humberside.

Format 80

YOU WERE KIND enough to review our word processor Format 80 in the February edition of *Practical Computing*. For the most part the review was accurate but there are some matters of fact we would like to correct.

The price of Format-80 is now £199: the article "Apple words" prices it somewhat higher.

John Dawson should be pleased to hear that word-wrap now operates when inserting text. Format-80 is compatible with Super R, Omnivision, Videx Videoterm, Doublevision, Smart Term, Vision 80, U Term, Full-View 80 and others.

Michael Hardwick,
Elite Software Company,
Heston,
Middlesex.

Alphabetical listing.

```
Program conversions from ZX81
to SPECTRUM.
The following show a sample of
the suggested amendments to
make use of the INPUT command
on the SPECTRUM.
 620>INPUT "Add 1, Subst 2, Dele
te 3, Scroll 4, Return 5 ";y
 660 IF y=2 THEN GO TO 860
 670 IF y=3 THEN GO TO 1040
 685 IF y=5 THEN GO TO 1190
 700 INPUT "Enter Name of new It
em ";x$
 720 LET a$(1)=x$
 740 LET l(1)=LEN x$
 750 INPUT "Enter Amount of new
Item";a1
 770 LET a(1)=a1
 790 INPUT "Enter Cost of new It
em";c1


1250>INPUT "Add 1, Subst 2, Dele
te 3, Scroll 4, Return 5 ";y
1310 IF y=1 THEN GO TO 690
1320 IF y=2 THEN GO TO 860
1330 IF y=3 THEN GO TO 1040
1345 IF y=5 THEN GO TO 1190
```

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West Germany **RAIR** Computer GmbH Clemensstrasse 5-7 5000 Köln 1 Telephone (0221) 219811 Telex 8881915
United States **RAIR** Microcomputer Corp. 4101 Burton Drive Santa Clara CA 95050 Telephone (408) 988-1790 Telex 677038

● Circle No. 110

Samurai means to
Samurai is built to s

Out of the world's most powerful economy comes the world's most performance-orientated executive computer. It's the Samurai from Micro Networks, a 16 bit business machine with a capability, features and a price that gives it a decisive edge over the competition from the other side of the Pacific.

As well as the thrust of the Intel 8086 power, there's an impressively engineered reliability that's wholly Japanese. 128K bytes of memory, 2.4 megabytes formatted floppy disk storage with standard IBM format compatability, communications

RRP £2795 ex

erve. The new 16 bit
rve today's executive.

and printer interfaces all come as standard. And on top there is a superb range of options.

The software available to Samurai users is extensive. A full library has been developed by Peachtree the world's largest microcomputer software house, for MS DOS* and CP/M86** Samurai's operating systems. It all indicates that here's a machine that's built to work alongside you in the toughest business environment.

The Samurai is backed by an aftersales service programme, the like of which has not yet been in the U.K. executive computer market. Just as an ancient Samurai warrior pledged total loyalty to his lord, so Micro Networks pledges every Samurai customer a total support package. A 12-month guarantee of course, but also a guaranteed no-quibble replacement. Extensive training is available, and a software hotline to enable business users to get fast answers to operating queries.

Micro Networks Limited
382 Kensington High Street, London W14 8NL
Telephone 01-602 7405/9

The Samurai is a product from Nissei Sangyo which is a subsidiary of Hitachi.

MICRO NETWORKS

To: Micro Networks Limited
382 Kensington High Street
London W14 8NL

Please send me more details of the 16 bit Samurai.

Name_____

Company_____

Position_____

Address_____

_____

_____

Phone_____ PC2

* MS DOS is the registered mark of Micro Soft
** CP/M 86 is the registered mark of Digital Research

● Circle No. 111

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COMPUTECH SYSTEMS

168 Finchley Road, London NW3 6HP. Tel: 01-794 0202

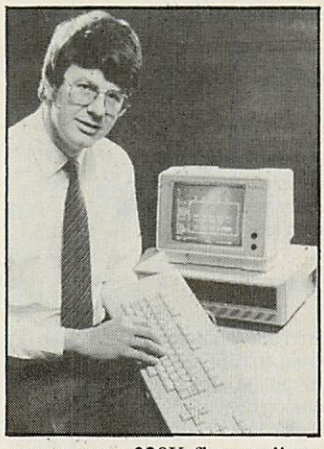
● Circle No. 112

The Apple logo is a trade mark of Apple Computer Inc. VisiCalc is a trade mark of VisiCorp.

Three from Texas

TEXAS INSTRUMENTS has entered the competitive desk-top business market with the TI Professional microcomputer. It is a 16-bit machine using the popular Intel 8088 CPU like the IBM Personal Computer. The oversized detached keyboard is more like the ones from Fortune and Wang.

The TI-P comes with 64K of RAM, expandable to 256K, and



one or more 320K floppy discs. It offers CP/M-86, Concurrent CP/M, MS-DOS and the UCSD p-system.

Meanwhile TI has also launched two further microcomputers, the TI-99/2 and CC-40, to strengthen its attack on the home and portable sectors respectively.

Contact Texas Instruments, Manton Lane, Bedford MK41 7PA. Telephone: (0234) 67466

ICL plumps for the Intel 8085

ICL HAS ANNOUNCED four new models of its micro, the Personal Computer, which is manufactured in the U.K. to a Rair design. Bottom of the range is the Model 15 with 64K of RAM and two 782K formatted floppies at £1,795. Top of the range is the Model 35 with 256K of RAM, a single floppy and built-in 10Mbyte hard disc at £5,125.

All the new models use the 5MHz Intel 8085 eight-bit processor, which can be simply upgraded to an 8088. The operating system supplied is either CP/M or MP/M for multi-user systems.

The Model 26 and Model 35 are fast enough for multi-user operation as they include 0.5 Mbyte of "virtual disc" or cache memory store. This allows very fast access to frequently used data without involving slow disc access.

Contact ICL, ICL House, London SW15. Telephone: 01-788 7272.

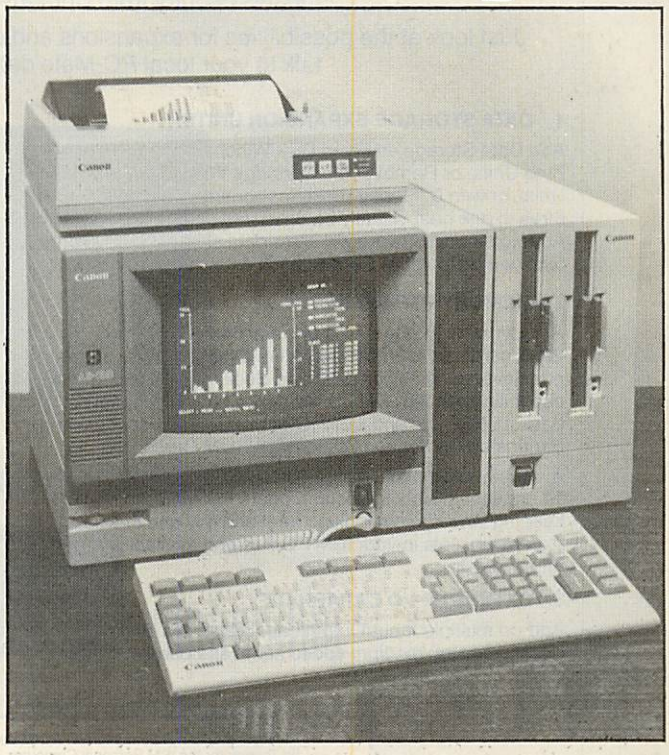
Canon's desk-top

THE FAMOUS Japanese camera and copier company, Canon, has launched a new 16-bit micro the AS-100. Apparently the label AS stands for "advanced station".

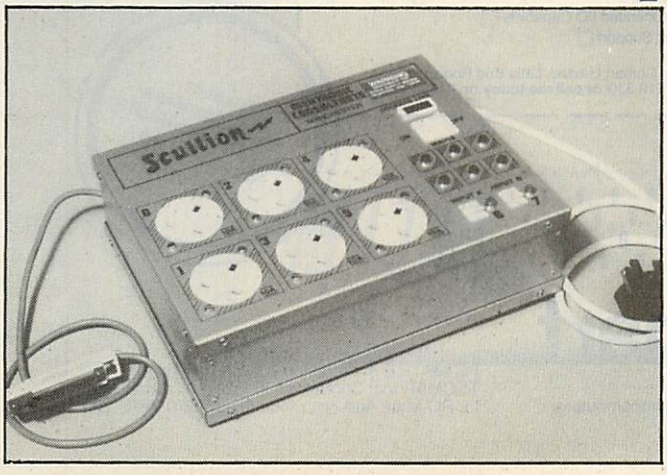
It comes in two versions, monochrome and colour. The AS-100 uses the Intel 8088 as its CPU and has 128K of RAM as standard, expandable to 512K. Two 5.25in. floppy discs are supplied, offering 640K of storage each; 1Mbyte 8in. discs are available as an option. There is a choice of operating system — CP/M-86 or MS-DOS may be specified.

Interestingly, a non-mouse knob-operated pointing device is available to plug into the detached keyboard to support the computer's normal graphics functions.

Contact Canon U.K. Ltd, Waddon House, Stafford Road, Croydon. Telephone: 01-680 7700.



Plug the Scullion into a Pet's User Port and the mains power supply, and up to six electrical devices can be switched on and off under program control using simple Peeks and Pokes from Basic. The Pet is fully isolated from the mains supply. The Scullion is suitable for stepper-motor control as well as turning on heaters, kettles and fish tanks, in fact anything drawing less than 10 amps. The unit costs £225. Further details from Mektronics Consultants, Linden House, 116 Rectory Lane, Prestwich, Manchester M25 5DB. Telephone: 061 798 0803.



Robot arm for the price of a toy

WOULD YOU SINCERELY like to get into robotics? If so, you could do a lot worse than invest in the Tomy Armatron at £30. There is nothing else even remotely near the price.

The arm traverses through 360°, as well as doing a 180° horizon-to-horizon swing. The claws, which are operated by knobs on the two control levers, are attached to a rotating wrist.

Tomy, a Japanese company, markets the Armatron as a toy. At the Earls Court Toy Fair, Tomy engineers admitted that it could quite easily be refabricated into something stronger and more durable. They also agreed it could be adapted to function under microprocessor control, especially a Z-80, for little more than the cost of the machine itself.

Where we disagree is with Tomy's reservation that it is suitable only for children over 12. The *Practical Computing* destruction testing team, aged six and three respectively, disprove that. After a weekend of Robot-arm wrestling, the Armatron was still functioning on the set of batteries it came with.

For further information contact Tomy on 01-661 1547

More news on page 24

ADD-ONS, ADD-INS AD INFINITUM

Tecmar's PC-Mate Add-ons will transform your IBM Personal Computer. They add breadth to its possible applications and depth to its capabilities. You can choose from over 60 PC-Mate Add-ons - all fully compatible with your IBM PC. You can improve your standard facilities, or add new specialised functions. You can share data storage and output resources between several PC's, or eliminate the need to purchase new PC's for more occasional and less demanding requirements.

Tecmar Add-ons are already proven in thousands of applications world wide, and are now available in this country from Comart–Tecmar's Sole UK Distributor.

Just look at the possibilities for expansions and enhancement–then send for further information, or talk to your local PC-Mate dealer. The possibilities are infinite.

1 DATA STORAGE EXPANSION UNITS

Add Data Storage as Fixed Disk Winchester in 5, 10 or 15M Byte Units, or Removeable Cartridge Winchester in 5M Byte Units, or twin 8" Floppy Diskettes–or any combination of all three in one neat visually co-ordinated unit. Shared System Adaptors and Software will allow data storage to be shared between up to 4 IBM PC's with full data integrity.

2 MEMORY EXPANSION

Add dynamic memory as individual 64K, 128K, 192K or 256K cards, or as integrated All-in-One cards with serial and parallel ports, plus calendar and clock. Add development capability with 32K CMOS Memory Cards with battery backup, EPROM and EEPROM Programmer/Readers and Expansion Cards, and Static RAM/ROM Cards.

A visually compatible expansion chassis provides a further 11 expansion slots to accommodate PC-Mate Add-ons, keeping your system looking neat and tidy and the expansion slots in your IBM PC free and available for future needs.

3 EXTENDED I/O CAPABILITY

Add-on multiple Input/Output capabilities in a single expansion slot; medium speed serial and parallel ports emulate IBM ports, and are fully IBM software compatible. Add Communications potential with multiple RS232 ports with optional DMA high speed data transfer capabilities. Add a further shared resource facility for up to four IBM PC's sharing a common printer.

4 INDUSTRIAL/SCIENTIFIC/LABORATORY INTERFACES

Add-on a full range of industrial, research and laboratory equipment and test device capabilities via an IEEE-488 Interface with an optional Software sub-routine library. Add-on multi-channel 8 and 12 Bit Digital/Analog converters, 8 to 16 Bit Analog/Digital converters or a Digital Input/Output option. Add-on stepper motor controllers, timers, counters and other aids to advanced data acquisition and process control functions.

5 GENERAL SUPPORT

Add-on a whole armoury of special purpose cards for voice recognition, video digitizing, special cursor movement control, timers/clocks/calendars, or external device control for security and energy conservation applications. You can also add-in the essential supporting software for all PC-MATE Units, and boards including useful sub-routine libraries.

Please expand my information on PC-Mate Add-ons and Add-ins specifically developed by Tecmar for the IBM Personal Computer

Name

Position

Company

Address

Tel No:

I am particularly interested in: (Please tick as appropriate)
Data Storage Expansion ☐ Memory Expansion ☐ Extended I/O Capability ☐
Industrial/Scientific/Laboratory Interfaces ☐ General Support ☐

To: Ken Goddard, Sales Manager PC-Products, Comart Limited, Little End Road, Eaton Socon, St. Neots, Huntingdon, Cambs PE19 3JG **or call me today on 0480 215005.**

Dealer opportunities are still available in selected areas

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Telephone 0480 215005.
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A member of the Comart group of companies

PC-MATE is the registered trademark of TECMAR Inc; Comart are the sole UK distributors for PC-Mate Add-ons produced by TECMAR.

● **Circle No. 113**

IBM profits near $4.5 billion

IBM HAS DECLARED a profit for 1982 of $4.409 billion on sales of over $34 billion.

IBM sales are thus running at around £85 million per working day, with profits of £11 million a day.

If IBM had sold its PC in the U.K. in 1982, and sold 200 a week for an annual turnover of £36.4 million, this could have increased profits by 0.1 percent. Wonder why it didn't?

CPS to import Winchesters

AUTHORISED IBM PC dealers CPS Data Systems are now importing PC-compatible Winchester hard discs from Tallgrass Technologies in the U.S. The TG-3012 is a 12MByte disc with integral tape back-up.

CPS also sells the Megaplus add-on board with 512K of RAM, three extra ports, and an interface which supports Tallgrass and Corvus hard discs.

Contact CPS at Arden House, 1102 Warwick Road, Acocks Green, Birmingham B27 6BH. Telephone: 021-707 3866.

Nominal ledger U.K.-style from Peachtree

U.K. VERSIONS of Peachtree's accounting systems and office-productivity systems packages are already available for the IBM PC. Now Peachtree has added the nominal ledger, which has been Britished by Peachtree International in Maidenhead, under contract to IBM.

As well as this, the basic accounting system includes Sales Ledger, Purchase Ledger and Inventory Management suites. The payroll package is expected to arrive in April with the new statutory sick pay facilities.

The office-productivity tools include Spelling Proof Reader, List Manager, Peachcalc financial modelling and Colour Graphics.

Later, Peachtree will start releasing its business management systems, written in Micro Focus Cobol.

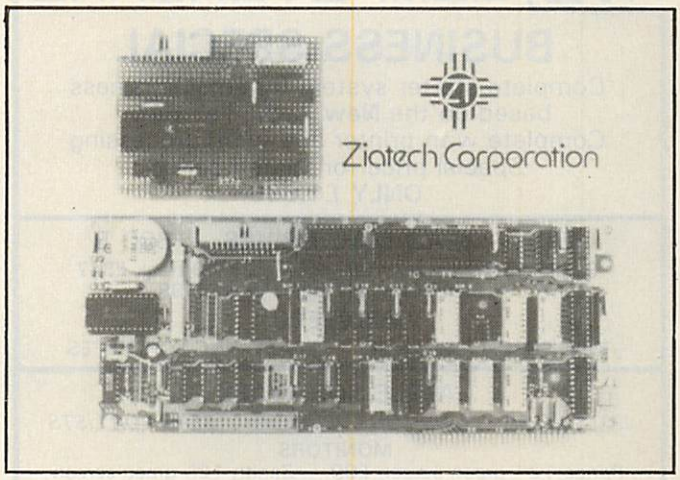
Contact Peachtree Software International Ltd, 43-53 Moorbridge Road, Maidenhead, Berkshire SL6 8LT. Telephone: (0628) 32711.

Three-function card saves space

ONE PROBLEM with the IBM PC is that it only has five expansion slots, which are quickly filled. Multifunction cards are therefore a useful development. Data Translation is offering the Ziatech 448 compatible card which fills one slot but has three complete separate functions. They are:

- GPIB controller — for daisychaining up to 14 GPIB compatible devices
- clock/calendar — with two-year battery back-up
- socket for multimode I/O board, with many available from various manufacturers. Examples are analogue I/O, maths processors, speech-synthesis chips, disc controllers and a second GPIB controller.

Contact Data Translation Ltd, 430 Bath Road, Slough, Berkshire SL1 6BB. Telephone: (06286) 3412.



Best-selling database manager for PC

A TOP-SELLING Apple program, DB Master, has been rewritten and expanded for the IBM PC. The new version has a 3,000-character record instead of 1,020. The database also has an Array Search feature to select records with multiple entries, and a Browse mode. Hardware requirements are a minimum of 192K of RAM and two 320K disc drives.

DB Master is from Stoneware Inc in California, and costs £349 from Pete & Pam, 103-5 Blegborough Road, London SW16 6DL. Telephone: 01-769 1022.

Mellow out the Easy way

THE EASY series of programs from Information Unlimited Software of Sausalito, California is now available from Pete & Pam Computers. The best-known offering is Easywriter II, which costs £225. It can be combined with Easyspeller, which costs £125 extra. The other two are Easyplanner, £125, and Easyfiler, £249.

Contact Pete & Pam Computers, New Hall Hey Road, Rossendale, Lancashire BB4 6JG. Telephone: (0706) 227011.

Comart peripherals

COMART LTD the microcomputer manufacturer and distributor, has signed an exclusive marketing agreement with Tecmar Inc to distribute the PC-Mate range of IBM PC compatible peripherals. They include Winchester hard-disc subsystems, memory and communications interfaces, analogue/digital converters and industrial control modules.

Comart's service division, Microserve, will be providing on-site maintenance for IBM PC users. Other Comart group members, including the Byteshop and Xitan Systems, will also be supporting the IBM PC.

Contact Comart Ltd, Little End Road, Eaton Socon, St Neots, Cambridgeshire. Telephone: (0480) 215005.

Appropriate Technology — Aptec for short — has launched a dual-language version of the IBM PC. The system includes the Arabstar word processor and a printer which can provide output in English, Arabic, or a mixtue of the two. The two languages can be mixed on the same screen — even on the same line — and Aptec's managing director Ali Baghdadi says they are working on further software. Contact Aptec Ltd at 2-4 Canfield Place, London NW6. Telephone: 01-625 5575 or 5134.

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NEW EPSON FX RANGE — PLEASE RING FOR PRICES

APPLE SOFTWARE
LOTS OF BARGAINS FOR EVERYONE — SEND FOR LISTS

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BMC 1401 14" RGB colour **£219** — Sanyo 14" RGB colour (80 col) **£524**

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A 12 Month subscription to LASERBUG @ £12.00 for 12 issues of the magazine
A 6 Month subscription to LASERBUG @ £6.00 for 6 issues of the magazine
An overseas subscription to LASERBUG @ £14.00 (Surface Mail – write for details of air mail)
..... LASERBUG Dust Cover(s) @ £3.25 each

I enclose a cheque/PO for £.....made payable to LASERBUG

NAME .....

ADDRESS .....

.....

Please send the completed form to: LASERBUG Dept. PC, 10 Dawley Ride, Colnbrook, Slough, Berks., SL3 0QH.

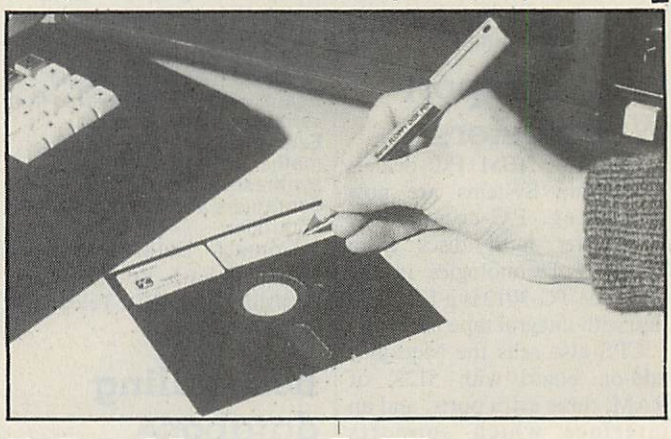
● Circle No. 197

Berol disc pen

ORDINARY PENS can damage discs and — even worse — cause loss of data which may be priceless and irreplaceable. Now Berol has launched a specially designed pen which is suitable for writing on floppy-disc labels. It has a unique safety tip that will bend before the floppy is damaged if the user presses too heavily.

The Berol is a well-designed British-made pen suitable for many types of fine writing and figure work, for flowcharting and for use with stencils. It is available in black, blue, green and red at a retail price of 45p.

For further information, contact Berol Ltd, Oldmeadow Road, King's Lynn, Norfolk. Telephone: (0533) 672705.



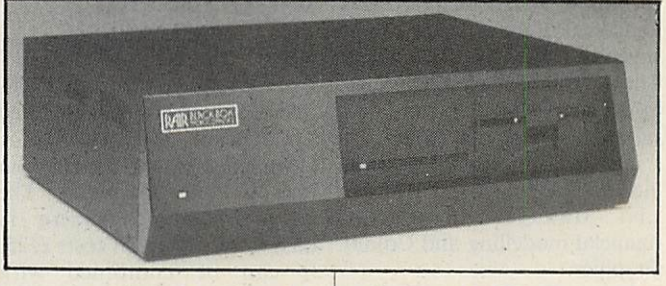
Midland Fair

THE COMPUTER FAIR has been a great success in London and Manchester. Now it is paying its first visit to the Midlands. It will be held at Bingley Hall in Birmingham on April 28-30. The Fair aims to display the widest possible range of home and personal micros, small business systems, games and other software.

By special arrangement with British Rail, low-price tickets are available from many stations. For example, you can travel from Berkshire or Gwent for only £10, or from Derbyshire and Leicestershire for only £5.50. These prices include the £2 admission charge to the exhibition, and children under 16 are half-price. For the cost from your local station contact British Rail at 021-643 2711.

The Computer Fair is sponsored by *Practical Computing* and *Your Computer* magazines — see the advertisement which is on page 186 of this issue.

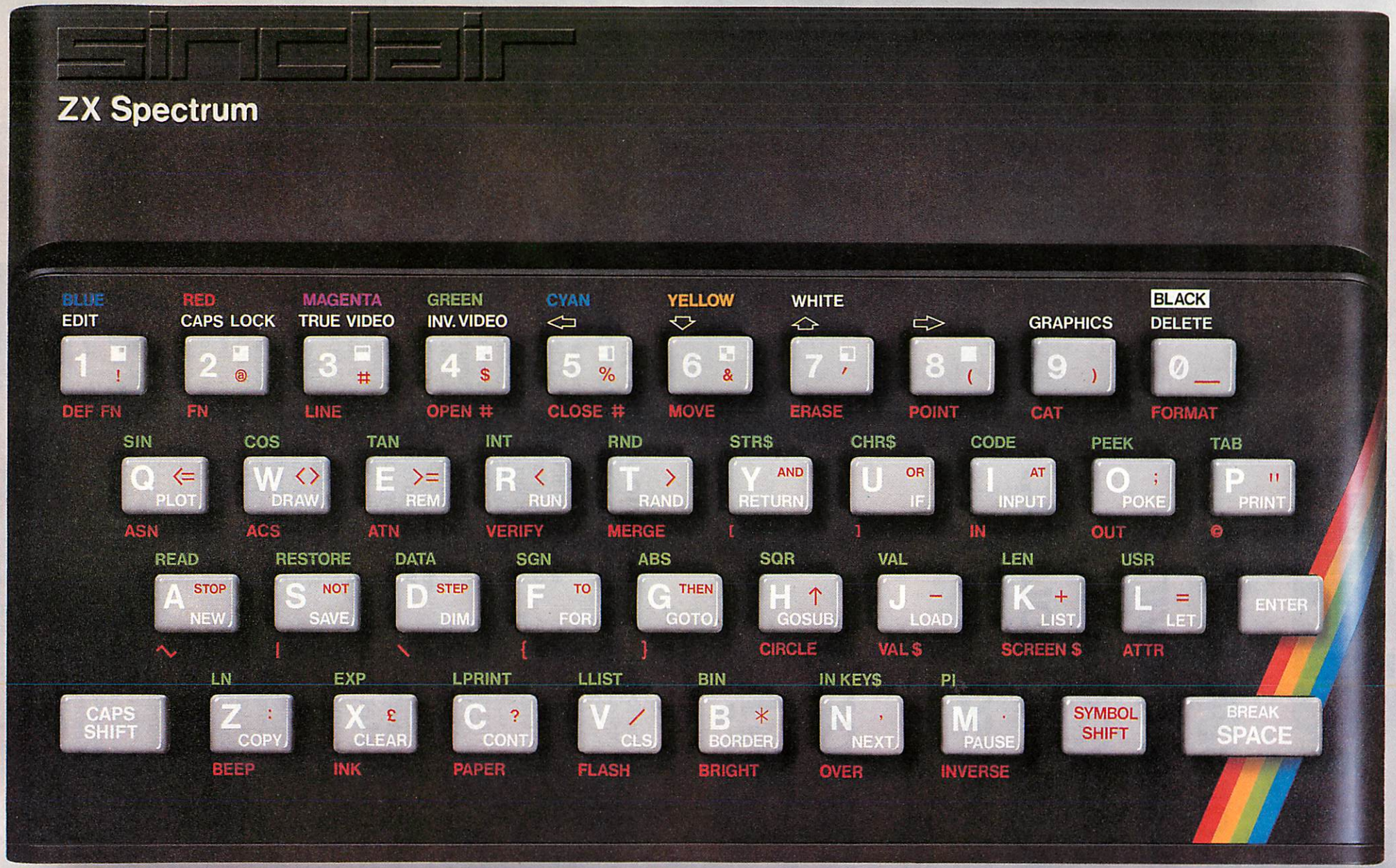
Rair's 3/60S runs MP/M-86



RAIR has launched another 16-bit micro to accompany the recent Rair 16. It is a new version of the old Black Box, designated the 3/60S. It features an Intel 8088 CPU, 256K of RAM and both floppy and hard discs. The floppy is 1Mbyte and the hard disc 19Mbyte, both unformatted. The operating system is MP/M-86.

The 3/60S is intended for multi-user, multi-tasking systems and will be sold both by Rair and by OEMs. Contact Rair by telephoning 01-836 6921.

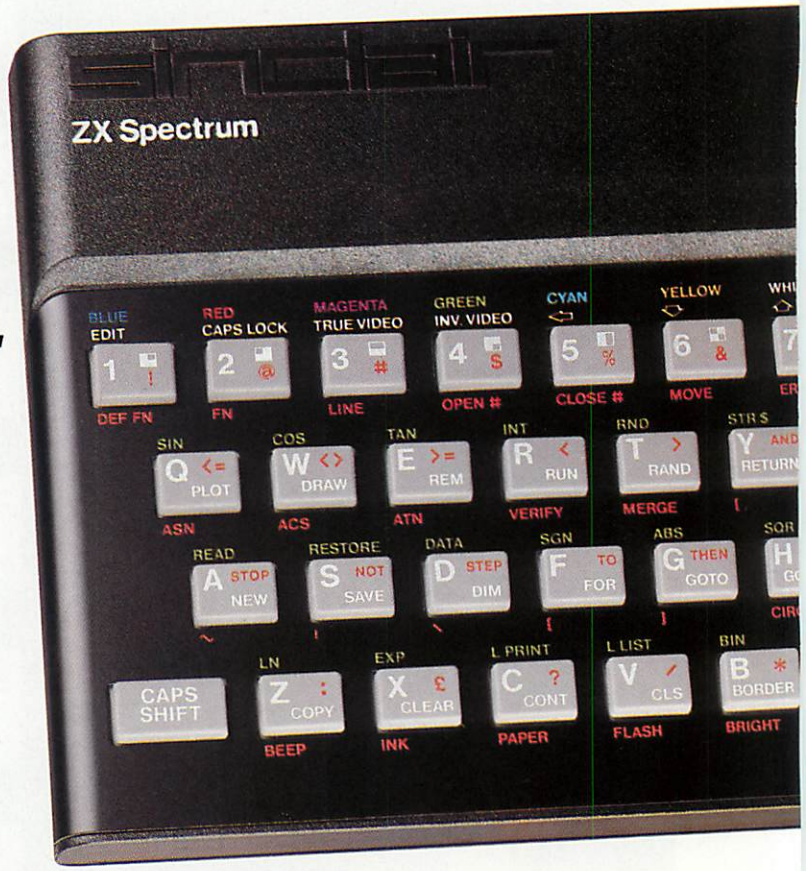
More news on page 29


sinclair
ZX Spectrum
BLUE EDIT
RED CAPS LOCK
MAGENTA TRUE VIDEO
GREEN INV. VIDEO
CYAN
YELLOW
WHITE
GRAPHICS
BLACK DELETE
1 ! DEF FN
2 @ FN
3 # LINE
4 $ OPEN #
5 % CLOSE #
6 & MOVE
7 ' ERASE
8 (POINT
9) CAT
0 _ FORMAT
SIN COS TAN INT RND STR$ CHR$ CODE PEEK TAB
Q ≤ PLOT ASN
W <> DRAW ACS
E >= REM ATN
R < RUN VERIFY
T > RAND MERGE
Y AND RETURN [
U OR IF]
I AT INPUT IN
O ; POKE OUT
P " PRINT ©
READ RESTORE DATA SGN ABS SQR VAL LEN USR
A STOP NEW ~
S NOT SAVE |
D STEP DIM \
F TO FOR {
G THEN GOTO }
H ↑ GOSUB CIRCLE
J − LOAD VAL $
K + LIST SCREEN $
L = LET ATTR
ENTER
LN EXP LPRINT LLIST BIN IN KEY$ PI
CAPS SHIFT
Z : COPY BEEP
X £ CLEAR INK
C ? CONT PAPER
V / CLS FLASH
B * BORDER BRIGHT
N , NEXT OVER
M . PAUSE INVERSE
SYMBOL SHIFT
BREAK SPACE

Sinclair ZX Specti

16K or 48K RAM... full-size moving-key keyboard... colour and sound... high-resolution graphics...

From only £125!



First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

Professional power– personal computer price!

The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can uprate later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

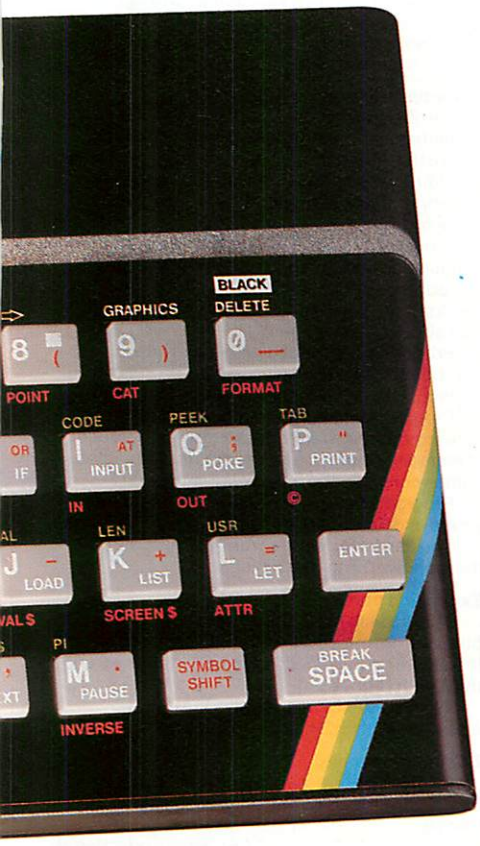
Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

There's no need to stop there. The ZX Printer – available now – is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.

Key features of the Sinclair ZX Spectrum

- Full colour – 8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound – BEEP command with variable pitch and duration.
- Massive RAM – 16K or 48K.
- Full-size moving-key keyboard – all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution – 256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set – with upper- and lower-case characters.
- Teletext-compatible – user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE – 16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC – incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

um



ZX Spectrum software on cassettes – available now

The Spectrum software library is rowing every day. Subjects include ames, education, and business/ ousehold management. Flight imulation...Chess...Planetoids... istory...Inventions...VU-CALC...VU-3D .Club Record Controller...there is omething for everyone. And they all ake full use of the Spectrum's colour, ound, and graphics capabilities. You'll eceive a detailed catalogue with your pectrum.

ZX Expansion Module

This module incorporates the three unctions of Microdrive controller, local rea network, and RS232 interface. onnect it to your Spectrum and you can ontrol up to eight Microdrives, ommunicate with other computers, and rive a wide range of printers.

The potential is enormous, and the odule will be available in the early part f 1983 for around £30.

sinclair

Sinclair Research Ltd, Stanhope Road, Camberley, Surrey GU15 3PS.
Tel: Camberley (0276) 685311.

The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.

The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing by providing mass on-line storage.

Each Microdrive can hold up to 100K bytes using a single interchangeable storage medium.

The transfer rate is 16K bytes per second, with an average access time of 3.5 seconds. And you'll be able to connect up to 8 Microdrives to your Spectrum via the ZX Expansion Module.

A remarkable breakthrough at a remarkable price. The Microdrives will be available in the early part of 1983 for around £50.

How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Barclaycard, Access or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. **Order**

Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum – 16K RAM version	100	125.00	
	Sinclair ZX Spectrum – 48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
			Total £	

Please tick if you require a VAT receipt ☐

*I enclose a cheque/postal order payable to Sinclair Research Ltd for £_____

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable

Signature

PLEASE PRINT

Name: Mr/Mrs/Miss

Address

PRC 904

FREEPOST – no stamp needed. **Prices apply to UK only.** **Export prices on application.**

Sinclair ZX Spectrum–technical data.

Dimensions

Width	233 mm
Depth	144 mm
Height	30 mm

CPU/ memory

Z80A microprocessor running at 3.5 MHz. 16K-byte ROM containing BASIC interpreter and operating system.

16K-byte RAM (plus optional 32K-byte RAM on internal expansion board) or 48K-byte RAM.

Keyboard

40-moving-key keyboard with full upper and lower case with capitals lock feature. All BASIC words obtained by single keys, plus 16 graphics characters, 22 colour control codes, and 21 user-definable graphics characters. All keys have auto repeat.

Display

Memory-mapped display of 256 pixels x 192 pixels; plus one attributes byte per character square, defining one of eight foreground colours, one of eight background colours, normal or extra brightness and flashing or steady. Screen border colour also settable to one of eight colours. Will drive a PAL UHF colour TV set, or black and white set (which will give a scale of grey), on channel 36.

Sound

Internal loudspeaker can be operated over more than 10 octaves (actually 130 semitones) via basic BEEP command. Jack sockets at the rear of computer allow connections to external amplifier/ speaker.

Graphics

Point, line, circle and arc drawing commands in high-resolution graphics.
16 pre-defined graphics characters plus 21 user-definable graphics characters. Also functions to yield character at a given position, attribute at a given position (colours, brightness and flash) and whether a given pixel is set. Text may be written on the screen on 24 lines of 32 characters. Text and graphics may be freely mixed.

Colours

Foreground and background colours, brightness and flashing are set by BASIC INK, PAPER, BRIGHT and FLASH commands. OVER may also be set, which performs an exclusive–or operation to overwrite any printing or plotting that is already on the screen. INVERSE will give inverse video printing. These six commands may be set globally to cover all further PRINT, PLOT, DRAW or CIRCLE commands, or locally within these commands to cover only the results of that command. They may also be set locally to cover text printed by an INPUT statement. Colour-control codes, which may be accessed from the keyboard, may be inserted into text or program listing, and when displayed will override the globally set colours until another control code is encountered. Brightness and flashing codes may be inserted into program or text, similarly. Colour-control codes in a program listing have no effect on its execution. Border colour is set by a BORDER command. The eight colours available are black, blue, red, magenta, green, cyan, yellow and white. All eight colours may be present on the screen at once, with some areas flashing and others steady, and any area may be highlighted extra bright.

Screen

The screen is divided into two sections. The top section – normally the first 22 lines – displays the program listing or the results of program or command execution. The bottom section – normally the last 2 lines – shows the command or program line currently being entered, or the program line currently being edited. It also shows the report messages. Full editing facilities of cursor left, cursor right, insert and delete (with auto-repeat facility) are available over this line. The bottom section will expand to accept a current line of up to 22 lines.

Mathematical operations and functions

Arithmetic operations of +, –, ×, ÷, and raise to a power. Mathematical functions of sine, cosine, tangent and their inverses; natural logs and exponentials; sign function, absolute value function, and integer function; square root function, random number generator, and pi.

Numbers are stored as five bytes of floating point binary – giving a range of $+3\times10^{-39}$ to $+7\times10^{38}$ accurate to $9\frac{1}{2}$ decimal digits.

Binary numbers may be entered directly with the BIN function. =, >, <, >=, <= and <> may be used to compare string or arithmetic values or variables to yield 0 (false) or 1 (true). Logical operators AND, OR and NOT yield boolean results but will accept 0 (false) and any number (true).

User-definable functions are defined using DEF FN, and called using FN. They may take up to 26 numeric and 26 string arguments, and may yield string or numeric results.

There is a full DATA mechanism, using the commands READ, DATA and RESTORE.

A real-time clock is obtainable.

String operations and functions

Strings can be concatenated with +. String variables or values may be compared with =, >, <, >=, <=, <> to give boolean results. String functions are VAL, VAL$, STR$ and LEN. CHR$ and CODE convert numbers to characters and vice versa, using the ASCII code.

A very powerful string slicing mechanism exists, using the form a$ (x TO y).

Variable names

Numeric – any string starting with a letter (upper and lower case are not distinguished between, and spaces are ignored).
String – A$ to Z$.
FOR-NEXT loops – A-Z.
Numeric arrays – A-Z.
String arrays – A$ to Z$.

Simple variables and arrays with the same name are allowed and distinguished between.

Arrays

Arrays may be multi-dimensional, with subscripts starting at 1. String arrays, technically character arrays, may have their last subscript omitted, yielding a string.

Expression evaluator

A full expression evaluator is called during program execution whenever an expression, constant or variable is encountered. This allows the use of expressions as arguments to GOTO, GOSUB, etc.

It also operates on commands allowing the ZX Spectrum to operate as a calculator.

Cassette interface

The ZX Spectrum incorporates an advanced cassette interface. A tone leader is recorded before the information to overcome the automatic recording level fluctuations of some tape recorders, and a Schmitt trigger is used to remove noise on playback.

All saved information is started with a header containing information as to its type, title, length and address information. Program, screens, blocks of memory, string and character arrays may all be saved separately.

Programs, blocks of memory and arrays may be verified after saving to confirm successful saving.

Programs and arrays may be merged from tape to combine them with the existing contents of memory. Where two line numbers or variables names coincide, the old one is overwritten.

Programs may be saved with a line number, where execution will start immediately on loading.

The cassette interface runs at 1500 baud, through two 3.5 mm jack plugs.

Expansion port

This has the full data, address and control busses from the Z80A, and is used to interface to the ZX Printer, the RS232 and NET interfaces and the ZX Microdrives.

IN and OUT commands give the I/O port equivalents of PEEK and POKE.

ZX81 compatibility

ZX81 BASIC is essentially a subset of ZX Spectrum BASIC. The differences are as follows.

FAST and SLOW: the ZX Spectrum operates at the speed of the ZX81 in FAST mode with the steady display of SLOW mode, and does not include these commands.

SCROLL: the ZX Spectrum scrolls automatically, asking the operator "scroll?" every time a screen is filled.

UNPLOT: the ZX Spectrum can unplot a pixel using PLOT OVER, and thus achieves unplot.

Character set: the ZX Spectrum uses the ASCII character set, as opposed to the ZX81 non-standard set.

ZX81 programs may be typed into the ZX Spectrum with very little change, but may of course now be considerably improved. The ZX Spectrum is fully compatible with the ZX Printer, which can now print out a full upper and lower case character set, and the high resolution graphics; using LLIST, LPRINT and COPY.
ZX81 software cassettes and the ZX 16K RAM pack will not operate with the ZX Spectrum.

sinclair
ZX Spectrum

Sinclair Research Ltd, Stanhope Road, Camberley, Surrey, GU15 3PS. Tel: Camberley (0276) 685311.

● Circle No. 115

Computer of the Year, 1982

PRACTICAL COMPUTING has recently participated with *Chip* magazine in Germany in voting for the 1982 Computer of the Year. Other magazines involved were *Databus* from Holland, *Microsystems* from France, *Bit* from Italy, Chip from Spain and *Personal Computing* from the U.S.

One problem was that not all the different countries have the same micros. In particular our vote for the Sinclair Spectrum in the home computer class was wasted, as exports had not then started.

The results were: Home Computer of the year, the Vic-20, Personal Computer of the year, the Sirius 1. Incidentally, the Vic-20 is called the VC-20 in Germany as "vic" sounds extremely rude to German ears.

London Computer Festival

THE ASSOCIATION of London Computer Clubs is holding its annual Fair at the Central Hall, Westminster, from April 14 to 16. This year it will be part of the first London Computer Festival, sponsored by the GLC and other bodies, which runs from April 3 to 17. For further details contact B M Goddard at 55 The Chine, London N21. Telephone: 01-360 0021.

Vertical marketing

VERTICAL MARKETING is the name of the current micro sales game with packages for accountants, solicitors, doctors, race-horse trainers, vets, butchers, bakers and so on. Macro profits beckon those who manage to fill a particular niche.

A two-day bash, starting on March 25, is being held at the Crest Hotel, Heathrow, the intention being to fill a gaping vertical gap in the computer conference market. It is called Selecting a Profitable Microcomputer Market, and is aimed at micro dealers.

The attendance fee is £165 and further details are available from Christine White, Interco Business Consultants, 1 Lancaster Park, Richmond, Surrey. Telephone: 01-948 3111.

Texet TX-8000 colour micro

WHEN WE REVIEWED the Oric 1 for this issue, there was only one colour computer for under £100. Soon there will be two. Texet — it claims to have been the first U.K. company to produce a pocket calculator in 1971 — has announced the Texet TX-8000 Colour Computer. It is an 8K, eight-colour home micro costing £98, which is only £1.95 less than the 16K Oric. However, Texet offers an upgrade to 64K for only £52, which will undercut both the Oric and the 48K Spectrum.

The keyboard is "full size moving-key rubber", and the use of a single Shift key and single-key space-bar suggest it will be just like the one on the Spectrum. There is one major difference between the TX-8000 and the Sinclair rival: the TX-8000 uses a 6502, not the Z-80.

Contact Texet, Commercial Avenue, Stanley Green Trading Estate, Cheadle Hulme, Cheshire. Telephone: 061-486 9231.

Trade Show '83

PRACTICAL COMPUTING is sponsoring The Computer Trade Show '83, to be held at the Wembley Conference Centre from April 26-28. The conference will include a trade exhibition and a series of seminars designed to bring manufacturers face to face with sellers.

The show is aimed at dealers, distributors, retailers, independent sales organisations, OEMs, systems houses and software houses. The fee is £90 for one day, £170 for two days, plus VAT.

Contact the Computer Trade Conference, IPC Business Press Ltd, Surrey House, Throwley Way, Sutton, Surrey SM1 4QQ. Telephone: 01-643 8040.

Business Press

THE NAME OF *Practical Computing's* parent company has been changed from IPC Business Press Ltd to Business Press International Ltd. This change has been made to reflect the very wide range of markets covered by the 100 publications of the company, and to identify its prime position as the world leader of business publishing.

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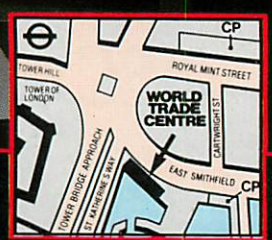

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HP joins High Street gang

Hewlett-Packard has always focused on the engineering and scientific market. Ian Stobie found HP set to fight for home and office sales.

FOR SOME TIME the Hewlett-Packard presence has been hovering expensively on the fringes of the volume personal-computer market. But a major TV advertising campaign and a two-day public exhibition at the Barbican Centre in London means that HP is moving beyond its traditional engineering and scientific base and pushing its personal computers into the rough and tumble of retail selling to ordinary consumers.

The TV promotion centres on the book-sized HP-75C portable computer, costing about £760 and described fully in *Practical Computing's* November 1982 issue and the January 1983 Portables special. Among the other HP hardware on show at the HP Personal Computer Event, as the Barbican exhibition was called, were the established Series 80 range of desk-top machines, the dual Z-80 based series 100 Model 20 micro launched at the end of last year, and the brand-new series 200 Model 16 16-bit micro.

The Model 16 is perhaps the most interesting machine. At the exhibition it was being demonstrated running the MBA package from Context, which integrates four standard applications — word processing, spread-sheet analysis, chart making and filing — into a single, data-compatible whole. With both Visicorp's VisiOn and Apple's Lisa due in the Summer, integrated software looks like being a major force in the microcomputer market this year. Although primarily aimed at engineering and scientific users, the Model 16 is a neat and compact machine, and with this type of software it may also prove attractive for use in a general office environment. HP has not yet finalised European arrangements for the Context package, but it could cost around £600 and be available almost immediately.

The main unit is very compact, measuring only 282mm. high by 315mm. wide by 488mm. deep. It houses the 9in. CRT display, a Motorola 68000 16-bit processor running at 8MHz and from 128K to 1Mbyte of RAM. The screen has 300-by-400 dot resolution, fully supported by the powerful HP Basic graphics features, and can display 25 lines of 80 characters text.

Use of the Motorola chip is a departure for HP, which usually builds around processors of its own design. The 68000 is a true 16-bit processor, moving data around in 16-bit chunks on the data bus and capable of addressing up to 16Mbyte of memory with its 32-bit wide address registers. To the user this means that the Model 16 is a fast machine, especially suited to calculation-intensive tasks.

The detached keyboard unit has a rotating knob mounted on the left, above the top row of keys. It is called simply the Knob, and can be used as a pointing device to move the cursor around the screen, to select menu options, for example, or to point to objects on the screen. Alternatively, it can control, via software, instruments attached to the Model 16. The Knob can be thought of as a simpler, one-dimensional version of the Mouse device used by the Lisa and VisiOn. HP's concept was originally developed for instrument-control applications and has been used on a larger non-retail HP series 200 machines for such tasks as moving radar masts. It is fully supported by Basic, with the Knob function and the On Knob Goto, On Knob Gosub and On Knob Call statements added to the language.

Pricing follows the HP tradition — it is not low. A typical 512K RAM system with screen and keyboard is £3,889 plus VAT, without discs. The twin 3.5in. disc unit is another £1,351, and Basic costs £247, so it would cost £5,487 to put such a system on your desk.

Basic on HP machines is generally a much more powerful language than micro-computer users are accustomed to. A typical ROM-based Basic like Applesoft occupies 12K including the system monitor. HP Basic 2.0 as supplied for the Model 16 occupies 256K and uses a further 21K of RAM as workspace. It includes a full-screen editor, allowing you to scroll the whole program under the screen window as you do with a word processor, and comprehensive insert, delete and renumber facilities.

The Basic is semi-compiled to speed up execution. Errors are checked for line by line as the program is entered in the normal microcomputer way, but when you run the program the first thing the system does is compile a symbol table, and this can trap further errors before any damage is done.

HP Basic can handle very large and very small numbers, with exponents in the range of plus or minus 308, and can display them to 16 digits precision. Strings can be up to 32K in length, which is far beyond what most Basics can handle and is put to use when the system is being used for data capture. The syntax for substring manipulation differs from Microsoft-style Basic and is closer to the proposed ANSI standard, taking the form

```
A$[start position, finish position]
```

and

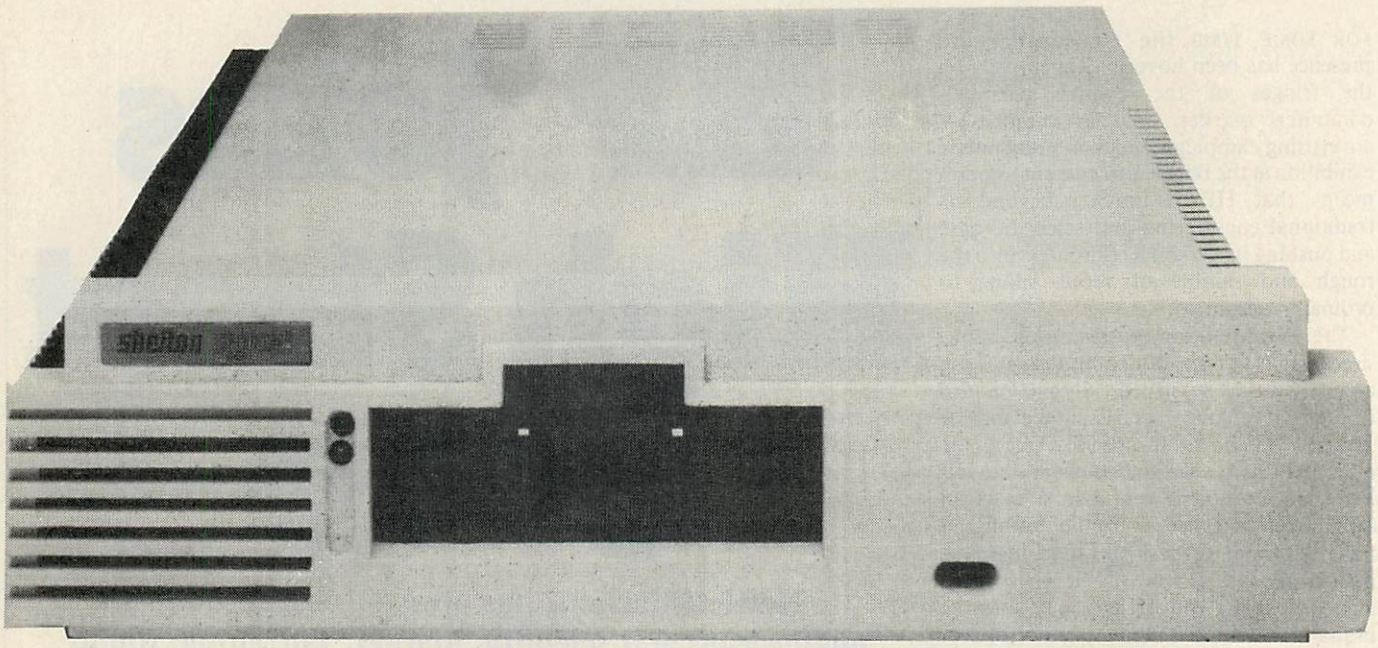
```
A$[start position; no. of characters]
```

Arrays can have up to six dimensions, and upper and lower limits can be set for array subscripts, which can be very large or even negative.

HP Basic is not a toy language and fully supports structured-programming techniques if you wish to employ them. Named subroutines can be defined and then called with a parameter list. They can be saved separately on disc and later merged into other programs, so you can simply build up libraries of reusable subroutines. Variables within subroutines can be specified as local to that subroutine or common to the whole program.

A full set of structured programming constructs is available, including Repeat-Until, Loop-Until, and Do-While. Case and Select as well as If-Then-Else-Endif are provided for selecting conditional actions. For selecting actions under the control of events in the outside world an On event Goto/Gosub/Call statement can be used with On Intr, On Timeout, On Key and On Knob. If HP Basic still does not seem adequate, there is a similar comprehensive implementation of Pascal available for the Model 16.

Circle No. 119



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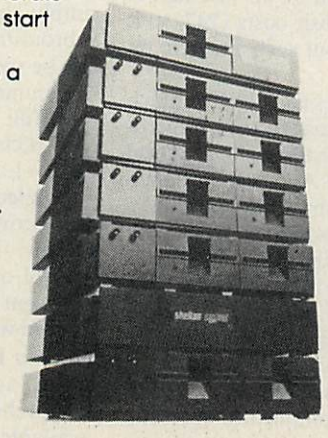

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● **Circle No. 120**

Make way for the "People's Winchester"

I SUPPOSE that the vast majority of the readers of this magazine are never likely to want to build their own computer, and many still never need to know more about their hardware than the size of the RAM memory array. But before turning the page to find out more about the latest operating-system software, disc drives or games packs, spare a thought for the humble chip that made it all possible.

This column is dedicated to the chips which form the heart of all computers and many computer peripherals, and each month I will be lifting the curtain on that mysterious world of the electronic engineer and the computer designer by taking a closer look at the latest semiconductor chips, what they do and how they do it.

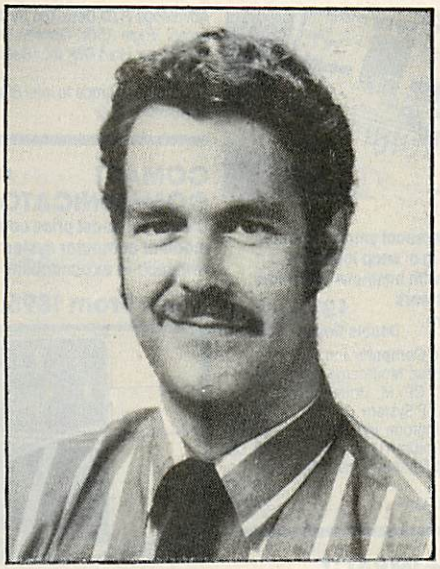
Even if you do not anticipate reaching for a soldering iron in the near future you should find it interesting; what's more you will steal a march on the readers of lesser magazines by gaining a shrewd idea of what to expect next from the microprocessor revolution. After all, today's chips will be used to make tomorrow's systems.

CP/M, as everyone knows, is *the* disc operating system for microcomputers. Is this because of its superior technical specification or the range of fancy features it offers? Alas no, it is simply because it has been around longer than most. It works with the 8080 and the Z-80 family of microprocessors, and most important of all there is a vast amount of software available at low cost to run under it.

Microcomputer users who do not have either the 8080 or the Z-80 in their machines sometimes go to extraordinary lengths to gain access to all that lovely CP/M software, as evidenced by the add-on Z-80 card available for the Apple and the 8080 emulator software available for the DEC PDP-11 family. Nothing, it seems, succeeds like success.

But technology marches on, and eight-bit microprocessors are soon to be replaced by the more powerful 16-bit devices like the Motorola 68000, and the Intel 8086. So is CP/M on its last legs? Thanks to CP/M-86 the latest verson of CP/M tailored to run on the Intel 8086 and its even more powerful offspring, the 80186 and the 80286 — the answer is no.

Of course competition is tougher now, and other operating systems for 16-bit machines such as the very elegant Unix will undoubtedly give CP/M-86 a run for its money. But my guess is that the no-frills



CP/M will remain with us for a long time yet. Certainly Intel must be thinking along those lines, because it has put the CP/M-86 code on to a 16K ROM chip coded the 80150.

CP/M in any of its versions normally resides on a disc, and is loaded into RAM during system initialisation by a small ROM-based bootstrap routine. It therefore takes up disc space, takes up

by Roy Coles

RAM space, and of course takes time to load. Having it available in a ROM is a big improvement.

Making up the 16K of firmware in the 80150 are three separate packages: the CCP or console command processor, the BDOS or basic disc operating system, and the BIOS or basic input/output sytem. The first two packages are pure CP/M-86 but the last has been developed by Intel to provide driver software for standard Intel peripheral devices such as the 8251 serial I/O controller, the 8255 parallel I/O controller, the 8275 CRT controller and, of course, the 8272 floppy-disc controller.

For most computer hobbyists bulk storage means cassette tapes or, for the lucky few, floppy discs. Yet the magnetic storage scene is changing fast, and before long even the humblest computer budget will find the funds for a low-cost micro-floppy drive or two.

The future lies with hard discs such as the Winchester, which consists of a rigid disc coated like a floppy and kept in a sealed container along with its associated read and write heads. The dust-free environment and the mechanical precision of the Winchester drive make it possible to pack much more information on to the floppy-sized magnetic disc, with the result that it is possible to pack tens of megabytes into the space previously required for hundreds of kilobytes.

Like all new developments, Winchester drives are expensive at the moment — but not for long, thanks to mass production and the omnipotent LSI chip. One device which will help to make the Winchester more attractive for use in low-cost personal computers is the μPD-7261 hard disc controller from NEC Electronics.

The 7261 is a 40-pin 5V operation NMOS chip. It is stacked to the pins with very clever circuitry, including an on-board microprocessor. The chip can handle as many as eight drives and under its own steam it can carry out the disc formatting, sector seek, read data and write data functions and so unload an otherwise onerus burden from the main processor. Data can be transferred to or from the chip at an incredible 12MHz rate, which puts it ahead of any current microprocessor. While it is reading the data it avoids mistakes by automatically detecting and correcting many errors by means of CRC or polynomial error-check codes generated during the write operation.

The on-board microprocessor is an eight-bit device with 64 bytes of RAM and 2.5K of ROM containing control code for the drive-management and data-transfer functions. The microprocessor makes the 7261 a "smart" chip which can be programmed to handle either of the two popular Winchester interface schemes, SMD or ST-506 — which are quite different in many respects. The microprocessor also acts as an interpreter of the hard-disc interface "language" which has 16 high-level commands such as Read Data, Write Data, Detect Error, and Seek.

Interfacing to the 7261 itself is made easier by the TTL compatibility of all the I/O lines, but some external logic is required between it and the drives. To take advantage of the high speed of the Winchester itself and the 12MHz transfer rate of the 7261 it will also be necessary to use a direct memory access, DMA, connection to the host microprocessor so that the whole disc sectors can be transferred without interruption.

With devices like the μPD-7261 becoming available, the "people's Winchester" cannot be too far away.

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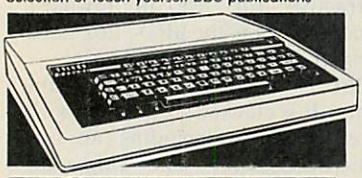

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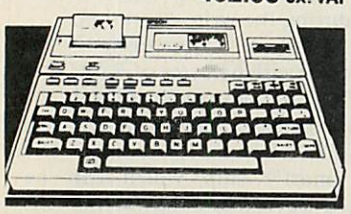

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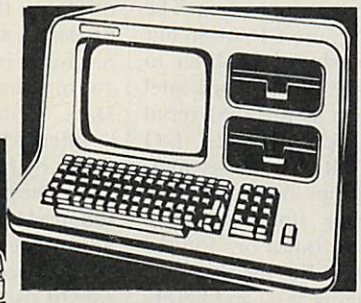

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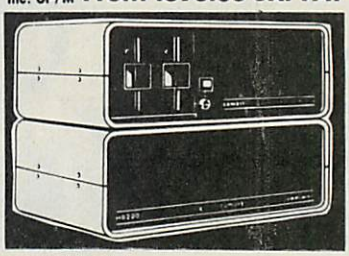

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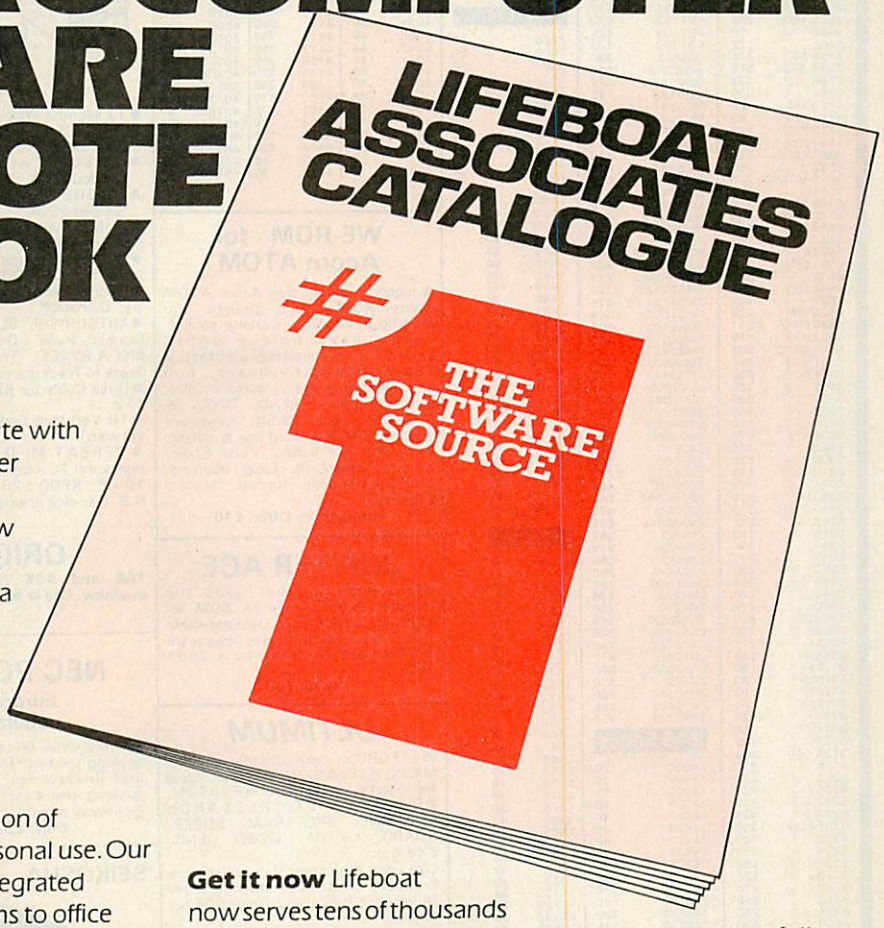

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74S138	100
74S139	115
74S155	39
74S158	195
74S175	260
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74S189	140
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TTL74

7400	11
7402	11
7404	13
7410	14
7411	15
7423	18
7414	20
7420	15
7422	20
7427	18
7430	14
7442	32
7447	40
7400	11
7448	40
7473	24
7474	20
7475	25
7485	60
7486	20
7489	170
7490	20
7491	35
7492	25
7493	25
74100	80
74116	50
74121	25
74125	35
74126	35
74143	210
74148	60
74150	50
74151	40
74153	40
74154	55
74186	470
74188	250
74383	99

74LS

LS00	11
LS02	11
LS04	12
LS08	12
LS10	12
LS11	12
LS13	15
LS14	26
LS19	58
LS20	13
LS22	12
LS27	12
LS32	13
LS30	12
LS42	28
LS47	35
LS48	55
LS83	120
LS73	18
LS74	18
LS75	20
LS85	42
LS86	16
LS90	24
LS91	60
LS92	32
LS93	23
LS125	24
LS126	25
LS138	25
LS139	28
LS148	70
LS151	40
LS153	40
LS156	36
LS157	25
LS158	30
LS175	36
LS240	55
LS241	55
LS242	55
LS243	55
LS244	50
LS245	70
LS273	54
LS373	60
LS374	55
LS393	42
LS471	629
LS640	180
LS641	180
LS645	180
LS668	125
LS669	120
LS670	100
LS673	550

CMOS

4000	10
4001	10
4002	12
4009	24
4010	24
4011	10
4012	16
4016	20
4017	32
4018	45
4023	13
4025	13
4027	20
4034	140
4040	40
4042	44
4051	45
4052	60
4053	50
4066	24
4068	14
4069	13
4070	13
4076	50
4077	13
4081	13
4093	20
4099	75
4160	95
4161	99
4162	99
4163	99
4174	99
4175	105
4411	690
4412	790
4419	350
4450	350
4451	350
4490	350
4500	675
4501	75
4504	75
4505	185
4508	130
4511	46
4519	30
4528	50
4549	375
4569	175
4583	90
4584	40
4585	60
4597	330
4598	290
4599	290
40101	130
40105	105
40106	35
40108	198
40110	198
40114	240
40163	50
40244	195
40245	195
40373	160
40374	245
45106	595

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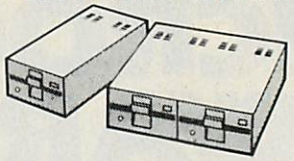

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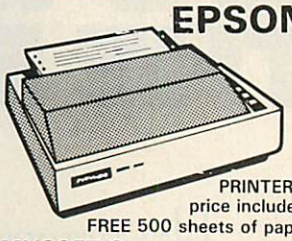

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1.843M	200	20.0MHz	200
2.0MHz	225	24.0MHz	170
3.2768M	150	24.930M	325
3.57594	98	48.0M	175
3.6864M	300	100.0M	375
4.0MHz	150		
4.433619	100		
5.0MHz	160		
6.0MHz	140		
6.144MHz	150		
6.5536M	200		
7.0MHz	150		
7.168MHz	160		
7.68MHz	200		
8.0MHz	150		
9.0MHz	200		
9.375M	350		
10.0MHz	175		
10.7MHz	150		
10.24MHz	200		
12.0MHz	175		
12.528M	300		
14.31818	170		

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16 way	130p	150p	120p	—p
20 way	145p	166p	125p	195p
26 way	175p	200p	150p	240p
34 way	205p	236p	160p	320p
40 way	220p	250p	190p	340p
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JUMPER LEADS Ribbon Cable Assembly DIL Plug (Headers)

Single Ended Lead 24" Long Length	14pin	16pin	24pin	40pin
24"	145p	165p	240p	325p
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12"	198p	215p	315p	490p
24"	210p	235p	345p	540p
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IDC female receptacle jumper leads

	20way	26way	34way	4way
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2 end	290p	370p	480p	525p

DIL SOCKETS

	Low Prof	Wire Wrap
8pin	8p	25p
14pin	10p	35p
16pin	10p	42p
18pin	16p	52p
20pin	16p	52p
22pin	25p	70p
24pin	25p	70p
28pin	28p	80p
40pin	30p	99p

RIBBON CABLE

Ways	Grey	Colour
	Price per Foot	
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34	60p	85p
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DIL PLUGS (Headers)

	Solder	(Dc
14pin	38p	95p
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DIN41617 31way 41612 A B	170p	—	—	175p
2-32way 41612 A C	275p	320p	220p	285p
2-32way 41612 A B C	295p	340p	240p	300p
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	.156"	.1"
TWO ROWS		
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2×22way	200p	199p
2×23way		185p
2×25way		225p
2×28way		210p
2×30way		245p
2×36way		295p
2×40way		315p
2×43way		395p

D CONNECTORS: Miniature

	9 way	15 way	25 way	37 way
Male				
Solder	80p	110p	160p	250p
Angle	160p	210p	250p	355p
Pins	120p	130p	195p	295p
Female				
Solder	110p	160p	210p	350p
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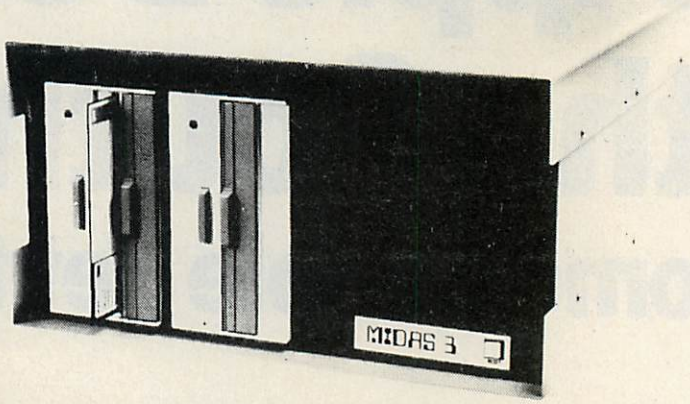

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74LS10	13p
74LS11	13p
74LS12	13p
74LS13	15p
74LS14	25p
74LS15	12p
74LS20	13p
74LS21	13p
74LS22	13p
74LS26	14p
74LS27	13p
74LS28	14p
74LS30	13p
74LS32	13p
74LS33	14p
74LS37	14p
74LS38	14p
74LS42	39p
74LS47	39p
74LS48	45p
74LS51	14p
74LS55	14p
74LS73	18p
74LS74	18p
74LS75	18p
74LS78	18p
74LS83	39p
74LS85	40p
74LS86	18p
74LS90	22p
74LS92	20p
74LS93	22p
74LS95	40p
74LS96	50p
74LS107	20p
74LS109	27p
74LS112	20p
74LS113	20p
74LS114	22p
74LS122	25p
74LS123	34p
74LS124	90p
74LS125	24p
74LS126	25p
74LS132	34p
74LS133	25p
74LS136	25p
74LS138	27p
74LS139	27p
74LS145	70p
74LS147	100p
74LS148	75p
74LS151	40p
74LS153	40p
74LS154	80p
74LS155	30p
74LS156	36p
74LS157	25p
74LS158	30p
74LS160	38p
74LS161	36p
74LS162	36p
74LS163	38p
74LS164	40p
74LS165	50p
74LS166	60p
74LS170	70p
74LS173	55p
74LS174	40p
74LS175	40p
74LS181	90p
74LS183	120p
74LS190	38p
74LS191	36p
74LS192	36p
74LS193	36p
74LS194	35p
74LS195	35p
74LS196	45p
74LS197	45p
74LS221	50p
74LS240	55p
74LS241	55p
74LS242	55p
74LS243	55p
74LS244	55p
74LS245	70p
74LS251	30p
74LS253	30p
74LS256	150p
74LS257	30p
74LS258	35p
74LS259	55p
74LS260	22p
74LS266	20p
74LS273	55p
74LS279	30p
74LS280	100p
74LS283	40p
74LS293	40p
74LS295	90p
74LS298	90p
74LS299	180p
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74LS324	150p
74LS348	90p
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74LS367	30p
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74LS390	45p
74LS393	45p
74LS395	90p
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74LS445	100p
74LS540	90p
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74LS628	150p
74LS640	100p
74LS641	100p
74LS642	100p
74LS643	100p
74LS644	100p
74LS645	100p
74LS668	100p
74LS669	100p
74LS670	120p
74LS682	300p
74LS684	300p
74LS687	400p

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74S00	30p
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74S04	30p
74S05	60p
74S08	60p
74S10	40p
74S11	50p
74S20	40p
74S30	40p
74S32	70p
74S37	60p
74S38	70p
74S51	70p
74S74	75p
74S85	450p
74S86	180p
74S112	90p
74S113	90p
74S114	90p
74S124	300p
74S132	110p
74S133	60p
74S138	120p
74S139	120p
74S151	250p
74S157	250p
74S163	300p
74S174	250p
74S175	320p
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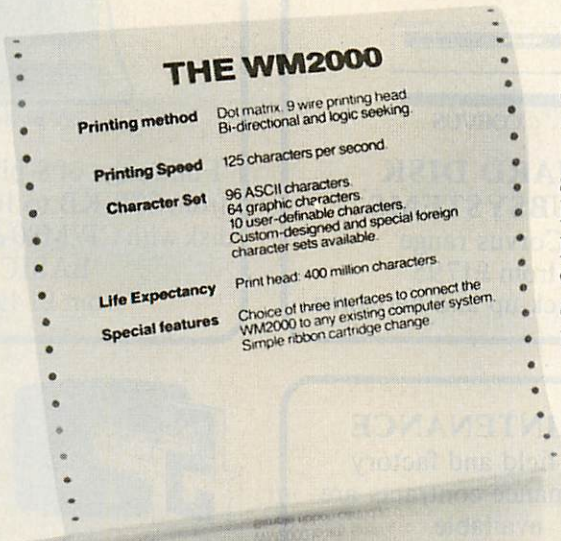
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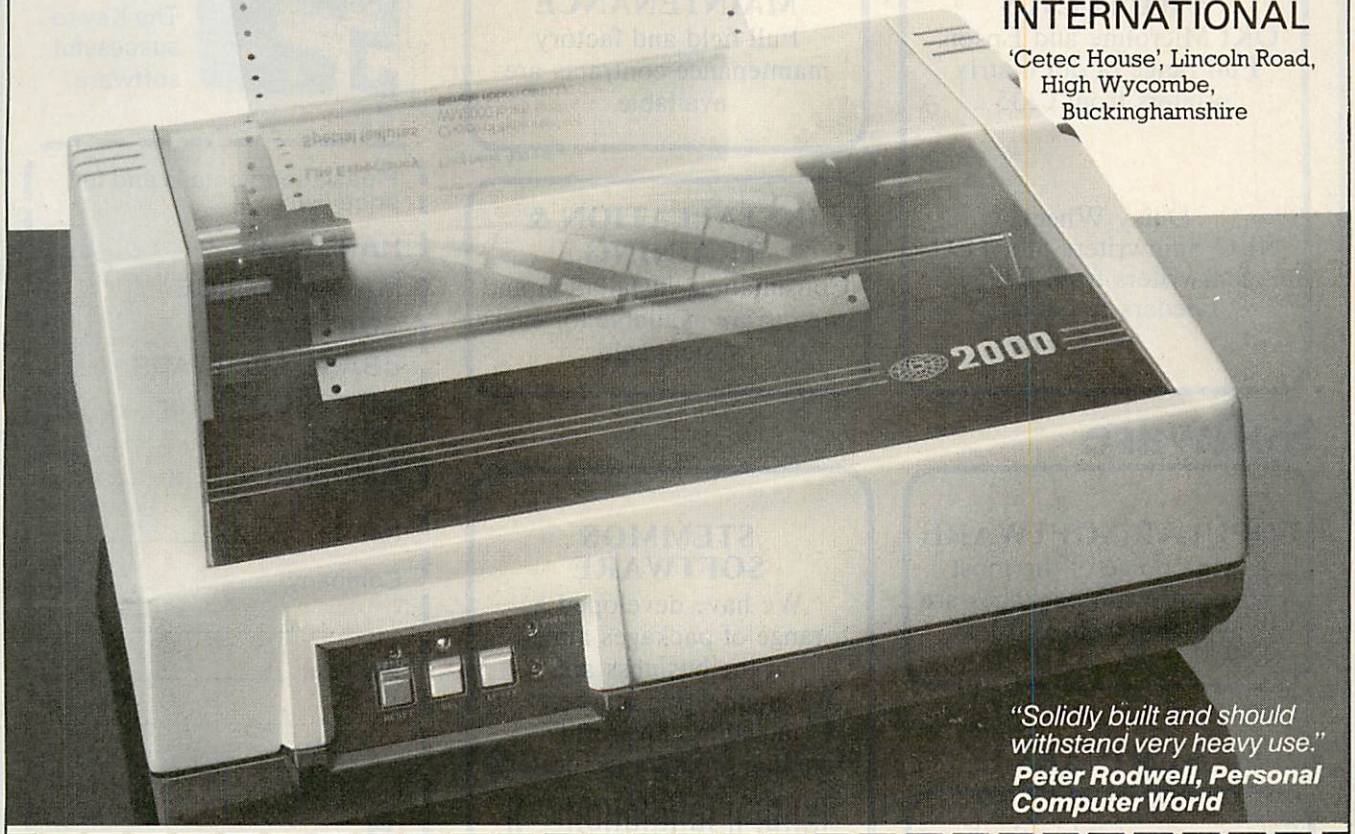

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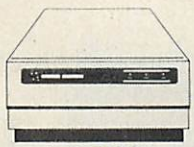

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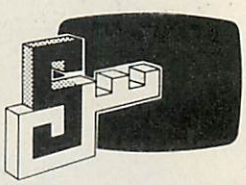

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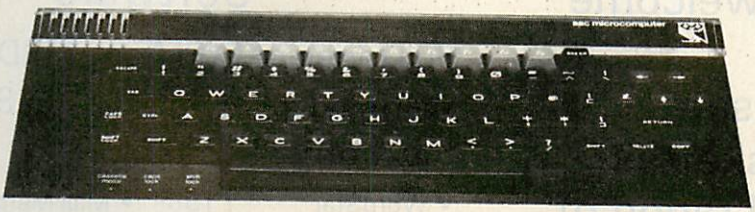

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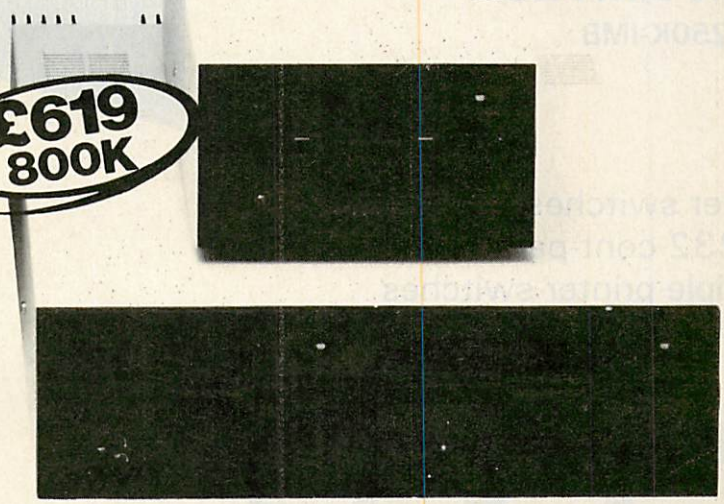

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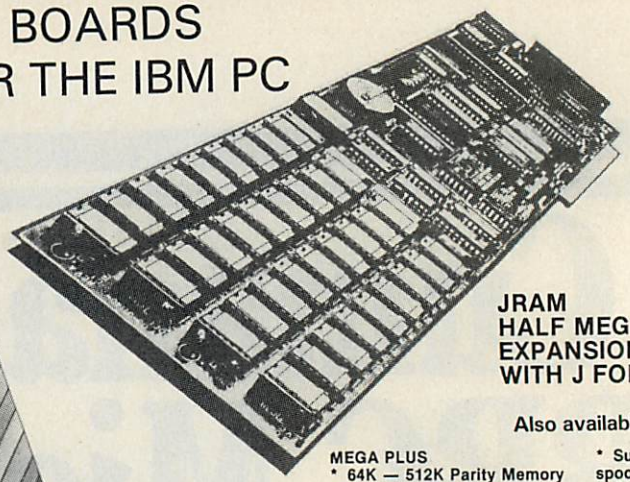

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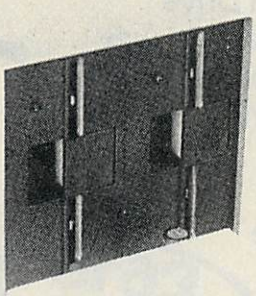

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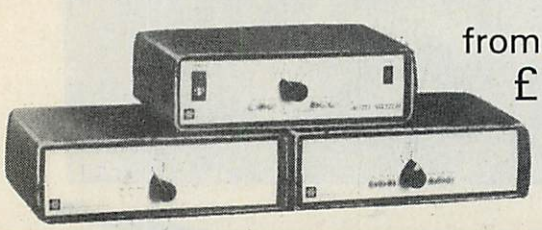

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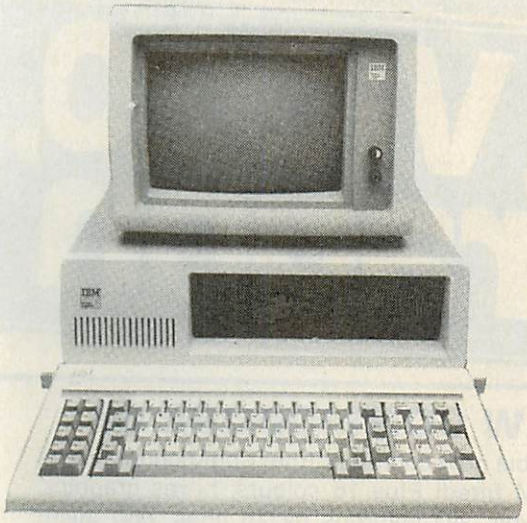

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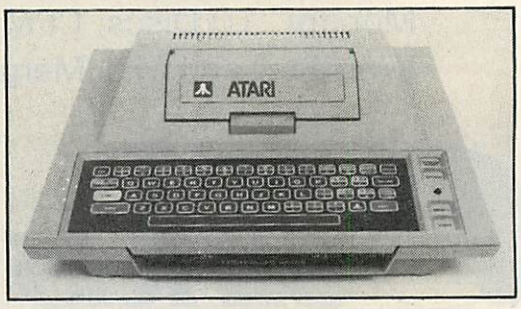

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32 computer hardware

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September Issue: Games Programs: Higher/Lower and Hangman, plus String Search Program. Articles on Debugging Programs, a safe verify, new user guide, Errata, Creating and Moving Multicoloured Characters, Logic on the Beeb, Ideas on Colouring and Shading, Acorns ROM replacement charge, plus much more.

October Issue. Program Features: Alien Attack, Calender Generator, Union Jack, and Memory Display Utility. Plus articles on Debugging, Improving Key Detection, Acorn Press Release on O.S. 1.2 and Issue II Basic, The Tube and Second Processor Options, a New Series for Less Experienced Users and Software Reviews.

Dec/Jan Issue. Program Features: Space City (Invader type game), Breakout, Artist (Joystick painting program), Rescue (Miraculously retrieves programs after Bad Loading or "Bad Program Message") and Pack — a program to compact basic programs and disc system review, Software reviews — including Wordwise, Book reviews, adding Joysticks interface to Model A; How to access the video controller chips and ideas for the newcomer; plus a new crop of hints and tips.

February Issue: Program Features: Beebmaze — Find your way through the random maze, guided by 3D views from inside the maze — an excellent game. Five Dice — a Beeb implementation of Yahtzee (R), a novel dice game. Also a listing of Windy Field — a creation from Acornsoft, Spiroplot screen doodler, and a complete memory display program in a user key. Plus Machine Code Screen Dumps for the Epson and Seikosha Printers; articles on Using Files, Ideas on Animation (Including a Rotating Cube program) an Introduction to the use of Procedures, a Survey of Books on the BBC Micro, and a Roundup of Disc System Hints. Plus a variety of Hints, Tips and Info, including a single VDU command to perform a Sideways Scroll. Win a Colour Monitor, Wordwise Word Processors and Acornsoft Graphics Books in our Third Software Competition.

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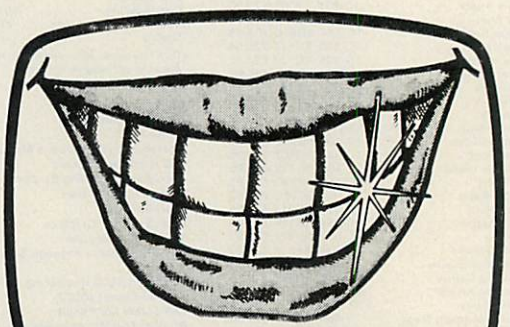

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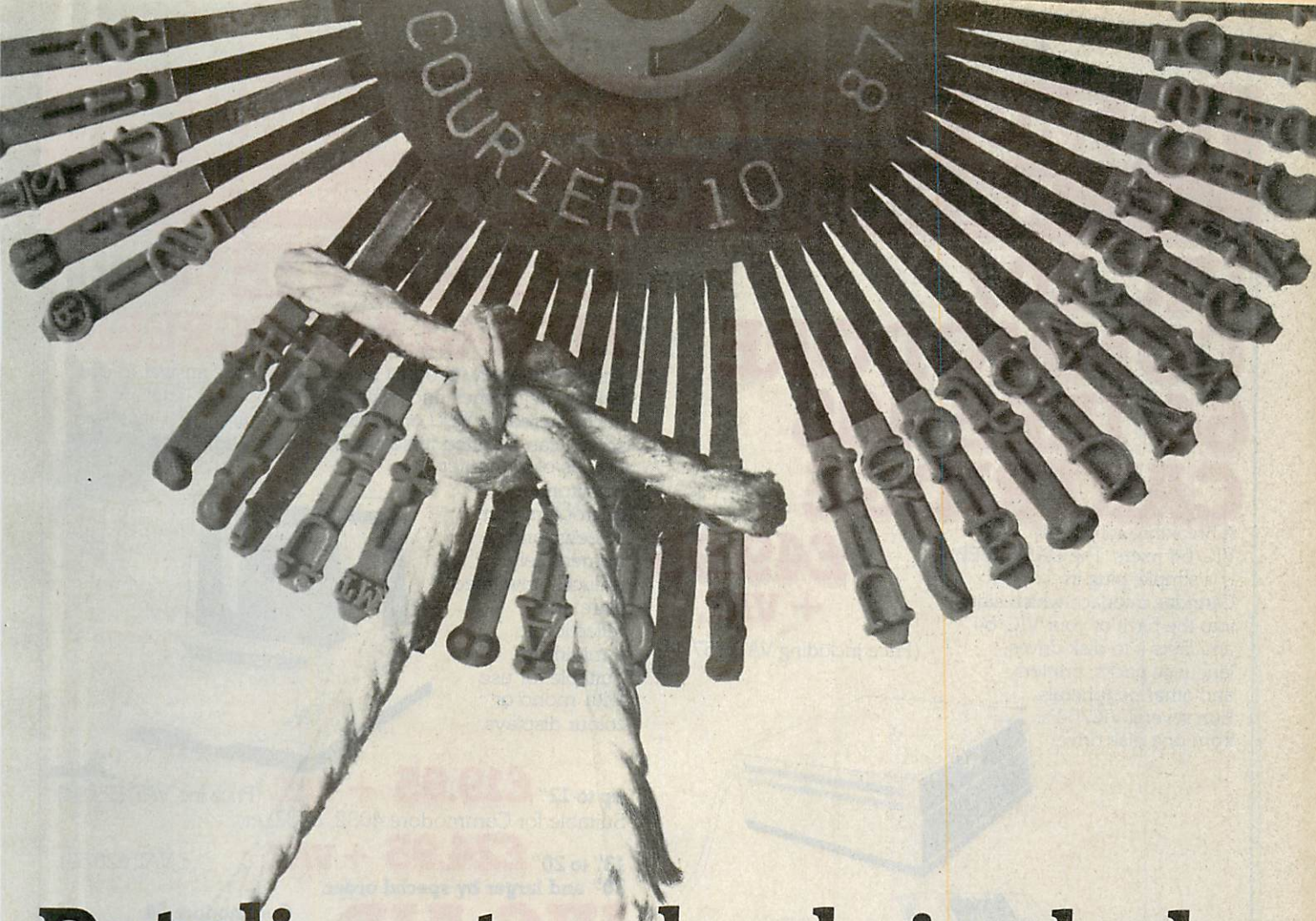

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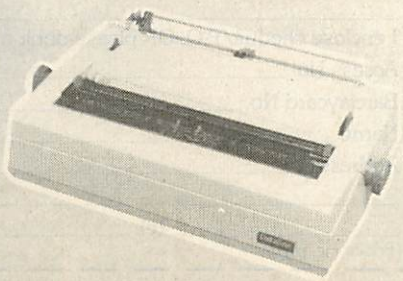

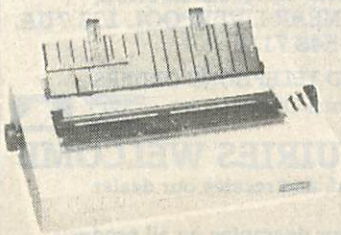

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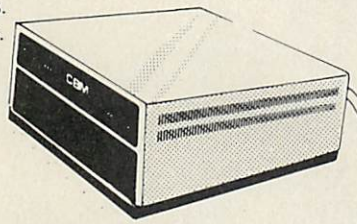

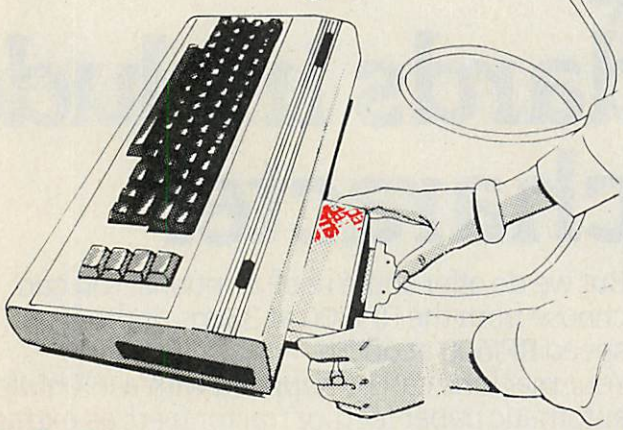

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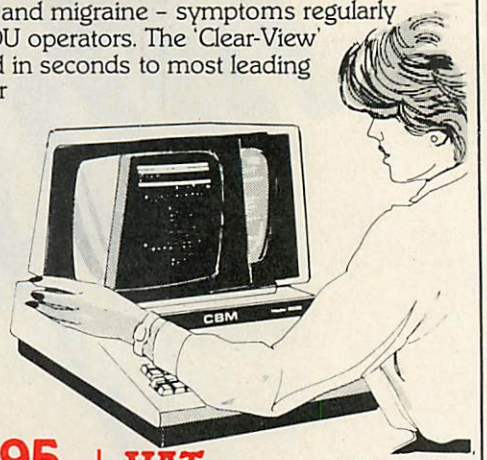

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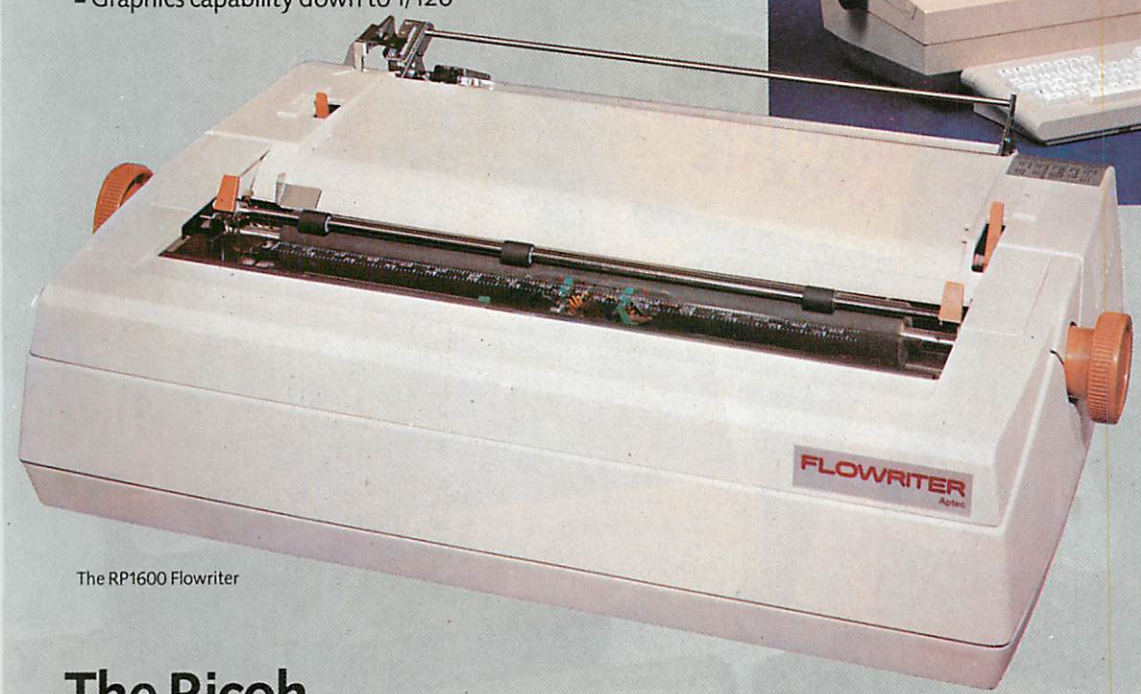

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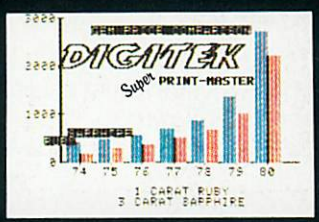

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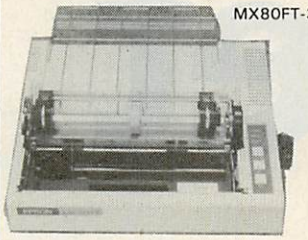

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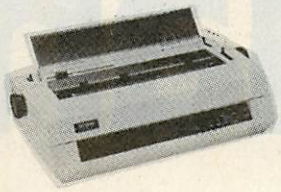

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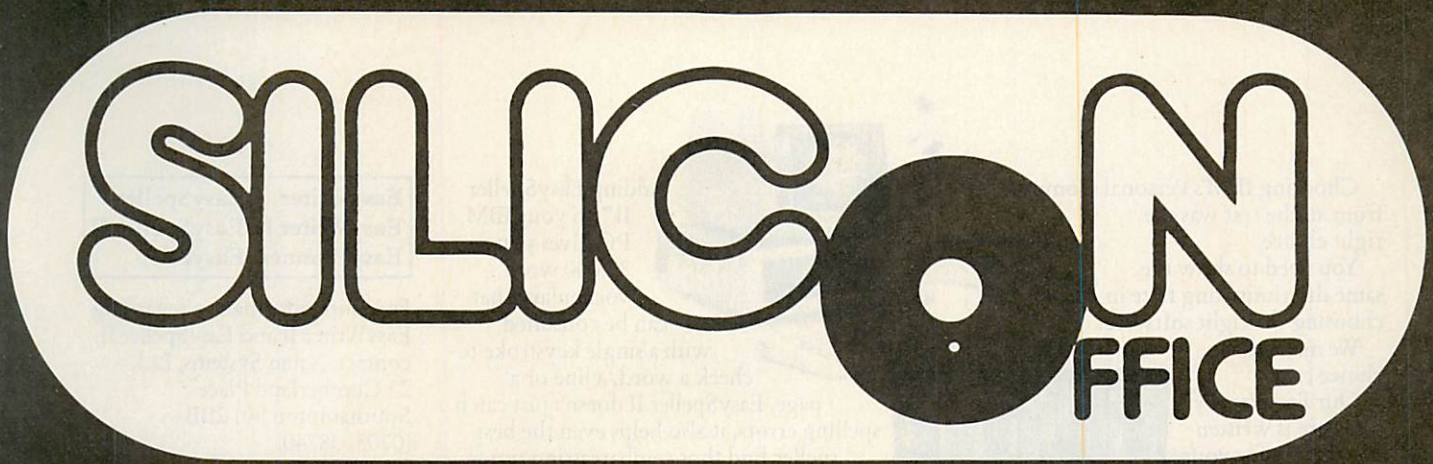

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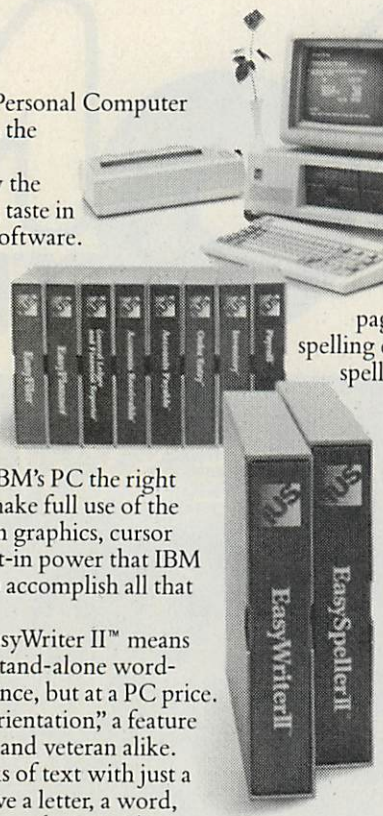

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● Circle No. 147

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MICRO DECISION HARDWARE FEATURES:

* *Two RS232C Serial Interfaces.*
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* *Floppy disk controller for up to four drives.*
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The following software is included, as standard, with every Micro Decision computer:

* *WordStar: MicroPro's Word Processing System.*
* *Correct-It: Morrow's Spelling Checker.*
* *LogiCalc: Software Product's Financial Modeller.*
* *CP/M 2.2: Digital Research's Operating System.*
* *BASIC-80: MicroSoft's BASIC Interpreter.*
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* *Micro Menus: Morrow's Operator Roadmap thru' CPM.*

The Morrow Designs optional intelligent VDU sits equally attractively on top of the Micro Decision or along side it. The VDU has a high resolution, green phosphor, anti-glare screen with 80 characters by 24 lines, and detachable keyboard allows positioning for maximum user comfort.

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NEW FROM ACT

The 10 Megabyte Winchester Sirius — — £3995·00

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Like all the Sirius range it's backed by the strength and resources of ACT: The PULSAR range of true 16-bit application software for accounting, planning and word processing; ACT Training Centres in London and Birmingham open to all; nationwide field service; a full range of printers and consumables. And, the most complete and professional dealer network in personal computing.

The new Sirius Winchester is the latest addition to the 16-bit ACT Sirius 1 family. Prices start at just £2395 for a dual floppy drive system with 1.2 Mbytes and £2895 for the double-sided floppy drive version offering 2.4 Mbytes. All provide an Intel 8088 16-bit processor and 128 Kbytes of RAM.

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- DMA interface to system memory
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- User configurable

General Specifications

- 128 Kbytes RAM
- Intel 8088 16-bit processor unit
- 1.2 Mbyte double-sided floppy disk drive for back-up
- 800 x 400 pixel high resolution graphics
- Multiple operating systems
- Parallel/IEE 488 port
- 2 x RS 232 asynchronous/synchronous ports
- User port

For more information on the new Sirius Winchester clip the coupon and return to

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SC1

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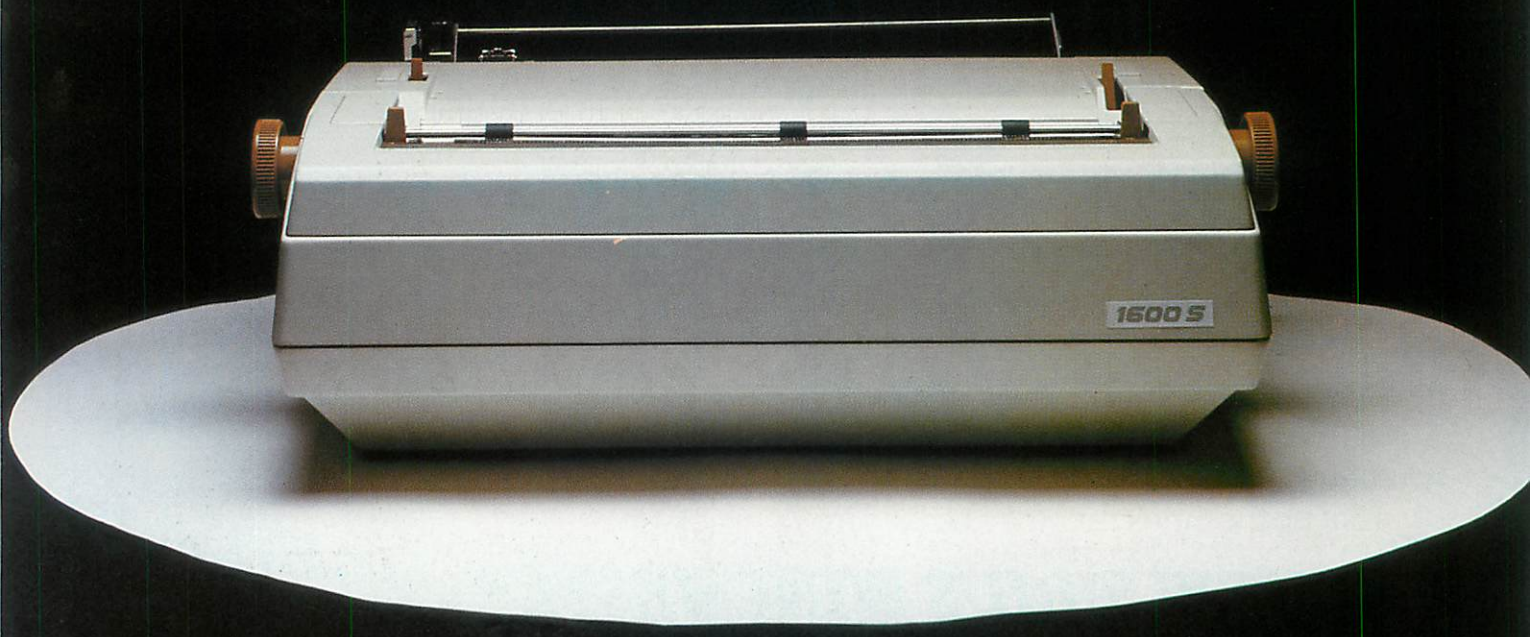

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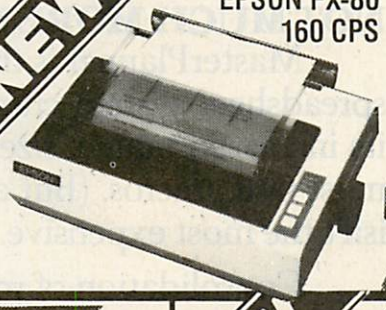

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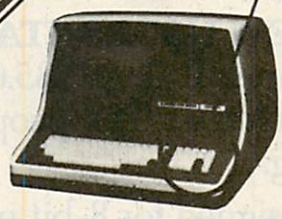

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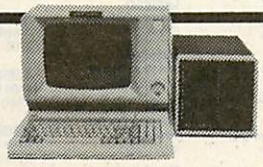

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● Circle No. 151

Our spreadsheet sys
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But which system should you buy? Surely no one system can meet the needs of all businesses?

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NEW USERS START HERE

PlannerCalc at £85.00* is now accepted as the first choice for people new to financial planning.

Designed for 8-bit micros, it boasts the kind of features that you'd expect to pay twice as much for. (Buy PlannerCalc's nearest rival and you'll have to.)

Unlike all other 'calc' products it allows you to enter calculations in a language you understand. Plain English.

For example:

LINE 1 SALES=100, 150, 175, 210
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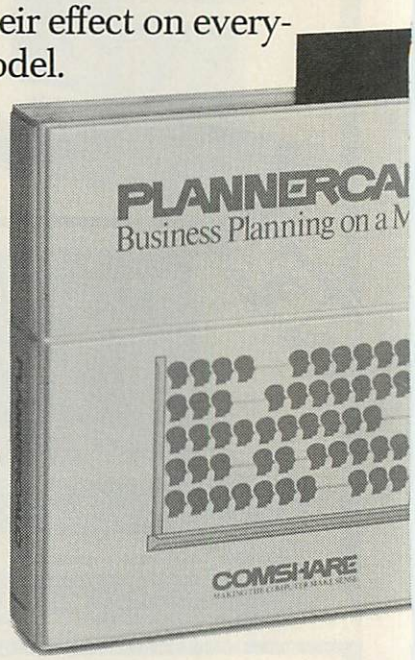
So it's much easier to use.

It uses the popular "spreadsheet" approach with a window that can be rolled in all directions.

Which means you can enter new figures and rules and immediately see their effect on everything else in the model.



It comes with the best manual on the market and it's suitable for most micros with a ™CP/M 2.2 operating system, 64K of memory, giving at least 900 cells, minimum screen width of 80 characters and 2 floppy disc drives.

MUCH MORE POWER, NOT MUCH MORE MONEY

MasterPlanner is the most powerful spreadsheet system currently available with its increased matrix size, 2000-3000 cells on most 64K micros. (But at £245* it certainly isn't the most expensive.)

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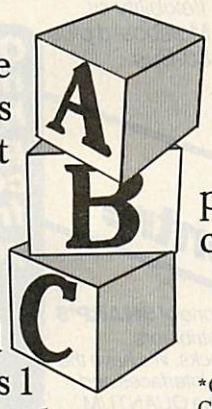
plan. Data transfer to word processing and other systems lets you incorporate figures in reports and output to a data base. It also has extensive formatting facilities which means you can produce reports that wouldn't look out of place in the board room.

It can store up to 25 standard reports to run when you need them. It's got full WHAT IF? analysis and direct editing of both spreadsheet and logic display.

JUST AS EASY TO USE

All this increased power doesn't mean you'll need a degree in advanced computing to understand MasterPlanner.

It works on exactly the same system as PlannerCalc and models written on PlannerCalc run without modification on MasterPlanner.



16 BIT VERSION

A new version of MasterPlanner has been specifically designed for the 16 bit micros like the Sirius 1 under ™CP/M-86 or the IBM personal using either CP/M-86 or ™MS DOS 1.1. With a vast matrix size of over 7000 cells on 128K and even more with larger memory, you'll at last be able to make the most of your micro.

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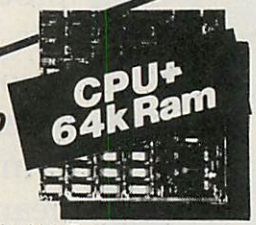

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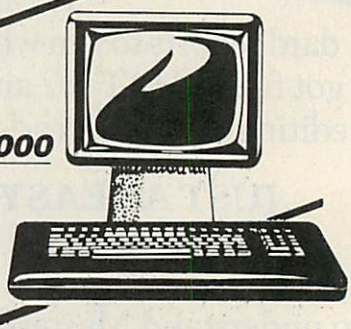

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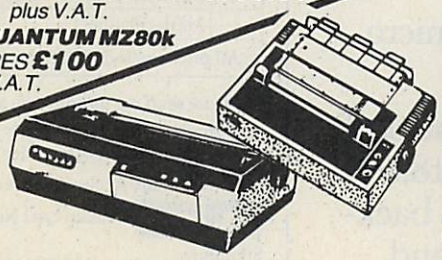

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K9 Terminal

Main features:

- 80 x 25 (including status line)
- Green display
- Seperate keyboard
- Function keys
- Self test
- Reverse video
- Underlining
- Half intensity
- Protected mode
- Line and block graphics
- Televideo compatible
- Baudrates to 9600

The K9 Terminal is undoubtedly one of the most competitively priced terminals available on the market today which can offer so many outstanding features.

The K9 Terminal is supplied to us by I.C.L. and includes the type of back-ups and product development that you would expect from a major manufacturer.

Delivery is ex-stock and this amazing terminal is now available at the incredible price of only: **£525.00** + V.A.T.

Insight Terminal

Main features:

As the K9 Terminal plus,

- Deeper contrast on screen
- Black screen surround (eliminates reflections)
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- Customised for Wordstar
- Optional 15" screen
- Optional graphic display
- Alternative emulations. VT52, Beehive

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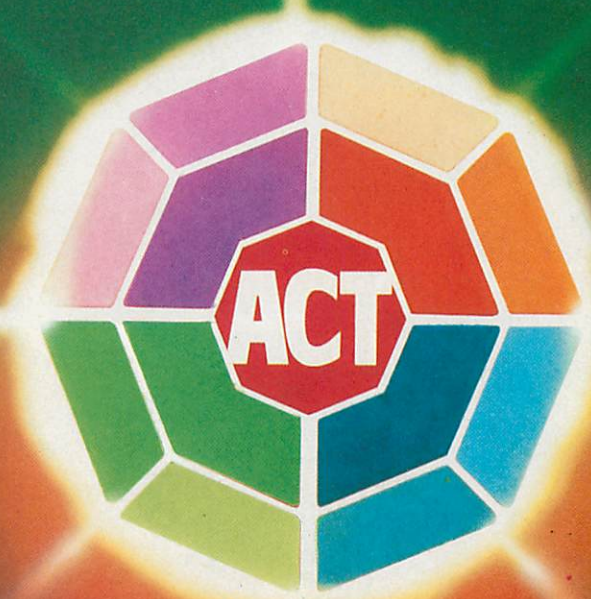

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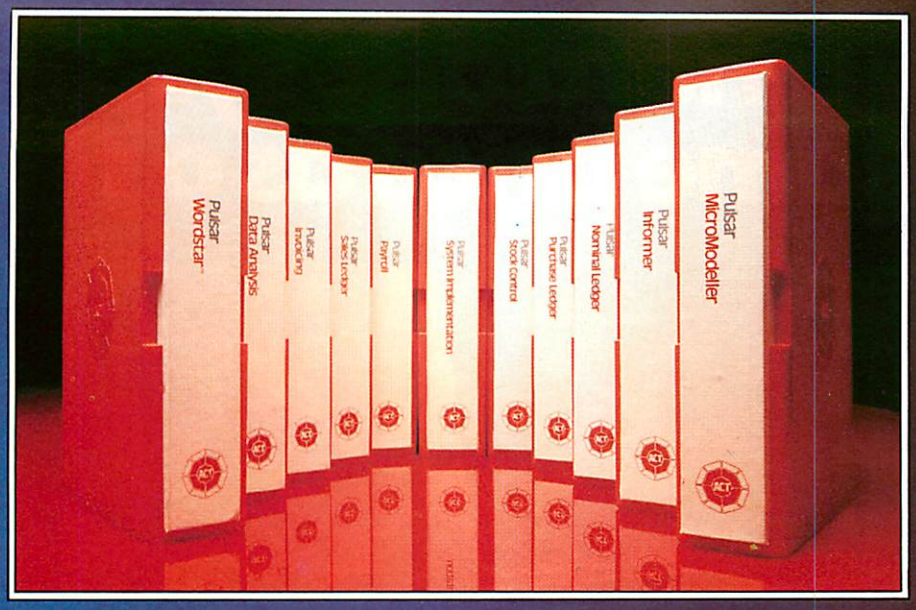

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OLIVETTI M-20

Jack Schofield tests this good-looking office micro built round the Z-8001 16-bit chip.

MOST COMPUTER MANUFACTURERS like to lead, or at least follow, the pack. Hence the proliferation of standard 64K CP/M micros over the last couple of years, and the current flood of 16-bit versions. At first glance the Olivetti M-20 looks as though it is designed to compete with the rest of the pack. On closer examination it looks individual, if not idiosyncratic. As one of the world's leading typewriter, word processor, computer and office-equipment manufacturers, Olivetti obviously feels it can go its own way. The danger is that it may end up going nowhere.

Equipment supplied for test was an L1 M-20 with two 5.25in. floppy-disc drives, black and white screen, and the PR-1450 80-column dot-matrix printer. All of it was made in Italy and to 220/240V standard.

Setting up is extremely simple. The main console includes both the drives and the keyboard. The tiltable VDU screen sits on top and is connected by only one cable, which also carries mains power. The printer is connected in the normal way but needs its own mains plug. Though they are not labelled each one only fits one port so there is no obvious way to connect them wrongly.

Turn on the power using the switch on the back and the M-20 beeps. After about five seconds it invites you to

Insert diskette and type Return

Hopefully even inexperienced users will know this is the key with a bent arrow.

You can insert the system disc in either drive as the M-20 checks both. This is fortunate as you can spend ages hunting through the documentation to find out which is which. As you learn from page 6 of chapter 10, Olivetti has not been boring enough to label the drives A and B, but 0 and 1. Drive 0 is the first drive — the one on the right. Drive 1 is the second drive — the one on the left. What a useful continental system this is.

Obeying instructions produces the systems information. In this case:

Total memory size: 160 Kbytes.
User memory size: 58390 Bytes.
Disk drive(s): 1 Ready.

This is not meant to imply the second drive is down, merely that it does not have a disc in it. It also provides the opportunity for some speculation. Where is the missing 100K?

Rather than equipping its machine with an obviously boring operating system such as MS-DOS, as on the IBM-PC, or CP/M-86 Olivetti has taken the trouble to write its own. Assuming it takes up about 40K, which would be reasonable, then where is the other 60K? Surely PCOS cannot take up 105,808 bytes. Looking at the files reveals PCOS.Sav at 73482 bytes, and PCOS loads Basic as well, incidentally there is a file called Edit. Abs at 19436 Bytes. A 19K editor? Whew!

Typing "basic" — all-lower-case commands are accepted — sends you instantly into PCOS Basic, which provides a user memory of only 34365. Note that this is a machine fitted with a 32K memory-expansion board, yet there is only 33.5K

(continued on next page)

Benchmarks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Olivetti M-20	1.1	4.0	8.0	8.4	9.2	17.1	26.5	1.2
IBM PC	1.4	5.2	12.1	12.6	13.6	23.5	37.4	3.5
Sirius 1	2.0	7.4	17.0	17.5	19.8	35.4	55.9	42.5

The Z-8001 based Olivetti ran the Benchmarks noticeably quicker than competitive Intel 8088-based machines. Unfortunately we did not have 8086-based and 68000-based micros available for direct comparison, though we will run these tests for a future issue.

OLIVETTI M-20

(continued from previous page)

free to Basic. It certainly makes you wonder about the advantages of buying a 16-bit micro. The 128K version would leave you just 1,939 bytes free to play with, which is only a moderate advance on the ZX-81 and well under the massive 3.5K user RAM provided by the Vic-20.

Presumably Olivetti did not write PCOS for fun but because it could not take MS-DOS or CP/M-86 off the shelf. And Olivetti could not do that because instead of building its 16-bit micro around the popular 8086/8088 microprocessor, the designers chose the obscure Zilog Z-8001.

But starting from scratch has its advantages. Everyone agrees that CP/M is not user friendly and MS-DOS is only slightly less hostile. The way is open to produce something much better, and with 128K of RAM to play with surely the space is there.

Granting that PCOS ought to be wonderful, the actual result is disappointing. Instead of using a friendly, menu-driven system like that on certain home computers and some expensive business machines, PCOS is effectively just like CP/M, only different. In one respect it is better: it uses simple, memorable two-letter commands such as vr for VRename or Rename Volume and fc for FCopy or Copy file. In another respect it is worse — all the things you already know about CP/M become a positive disadvantage. You already know you want Dir, but you have to think of the Olivetti for it. Ah, vl for Volume List.

One of the worst things about CP/M is the error reporting. It tells you things like, to give a famous example,

BDOS ERROR ON B: BAD SECTOR

when it should really say "Close the drive door, dummy" Here again PCOS does not represent much of an improvement. It simply says Error 92. You look this up in the manual. Again it does not say "close drive door" but "command not found — an invalid keyword has been entered". This is annoying, as a valid instruction certainly has been entered — it is just not an error the designers have allowed for.

Anyway, the manual says there are 127 PCOS error codes, and though not all of them are used 28 are given in the manual. They range from Error 7, when the program is too big for the memory available, to Error 111, invalid device name. You can get some puzzling unutilised errors for which there is no explanation. In Basic, but not in PCOS, they are given the additional explanation "unprintable error", which is jolly useful as it saves you looking it up in the manual only to find it isn't there.

Olivetti has provided an extra facility for those users with masses of spare RAM. It is possible to PLoad the Eprint. Sav file, which takes up just over 1K, and which then becomes part of PCOS. This then has the function of adding a little comment to the error number, so you get

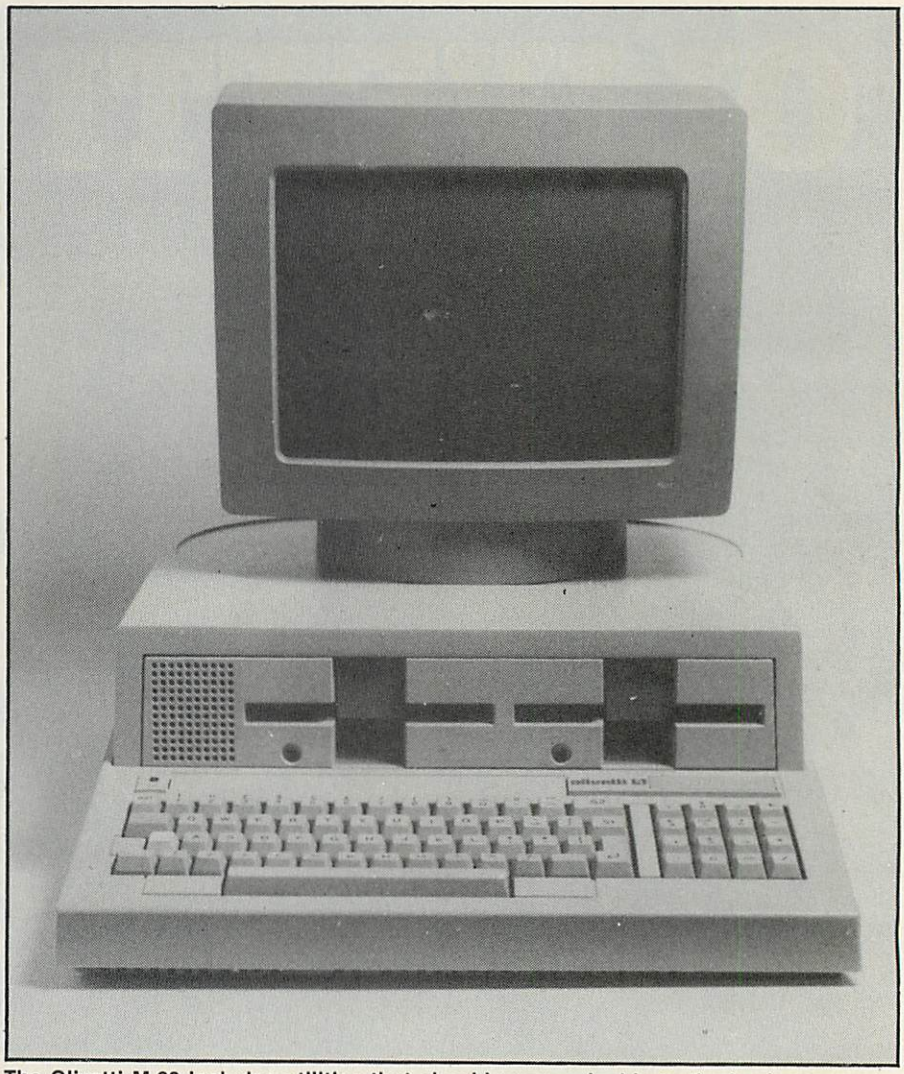
ERROR 92 — command not found

It is possible to type "he", for help, and then key in the error number. The PCOS system disc includes a large number of .Dat files which provide fuller explanations of the error codes without driving you back to the manual.

If all this were part of CP/M it would be wonderful. As part of PCOS it makes the system just about bearable, but in the end error numbers belong to 1979, not 1983.

PCOS does have some good points. For example, our vl will page all the files in order with the number of bytes, number of sectors used and allocated, and other information. Using vq provides a quick CP/M-type listing. Using va provides an alphabetical list — as long as the disc is not write-protected.

It also includes utilities that should prove valuable to the business user. The built-in password-protection scheme is an example. It is very simple to set up the parameters to control Olivetti printers, as you just need to type SForm then enter the parameters.



The Olivetti M-20 includes utilities that should prove valuable to the business user.

Specification

CPU: Z-8001 running at 4MHz
Operating system: PCOS
Memory: 128K RAM expandable to 224K with three 32K boards; as tested — 160K
Bus: five-slot expansion bus
Discs: two 5.25in. with 320K of unformatted storage each; transfer rate 250Kbit/s
Standard interfaces: parallel printer interface: RS-232C serial interface

KEYBOARD
Type: built-in with 72 keys, including 16-key numeric/cursor control pad
Features: auto-repeat on all keys; top row can be used as function keys; Basic language keywords optionally available on ASCII version

DISPLAY
Type: detached 12in. monochrome screen with brightness control
Displays: 64 characters by 16 lines, or 80 by 25 lines; 512 by 256 pixels
Colour: optional

DIMENSIONS
Basic unit: 430 × 519 × 155mm., weight 11kg.
Display: 334 × 310 × 260mm., weight 9kg.

The keyboard is typewriter style with a 16-key numeric keypad added and two curious extra Return keys S1 and S2.

For printer type you just give the number — though one wonders what happens with non-Olivetti models. PCOS provides good facilities for customising both the keyboard and the operating system by adding to it but not, unfortunately, by subtracting from it — so it is suitable for turnkey applications. All you need is an Init.Bas file on your program disc and the M-20 scoots through the system stuff, and Basic, and loads and runs this straight away.

Does the world need PCOS? No it does not, and if Olivetti wants to appeal to the general microenthusiast then the sooner it offers both a CP/M-80 emulator and CP/M-86 the better.

The M-20 is effectively a one-piece unit, though the screen is not actually attached to the top of the console. It is not particularly small, and monopolises a desk in a way that micros with detached keyboards do not.

The keyboard is typewriter style with a 16-key numeric keypad added. The keys have a nice feel and give a positive mechanical click when pressed.

At first the keyboard looks short of programmable function keys. However, the top 12 keys from 1 to ^ are effectively function keys when pressed with either the unlabelled orange Command key or the light-blue unlabelled Control key on the left of the keyboard. Templates can be fitted into two slots just above the keys. A template supplied with the Oliword program includes such functions as Forced Blank, Center and Decimal Tab.

The keys on the numeric keypad may also be programmed and in Oliword can be used for macros via the Learn/Execute utility, but then they can no longer be used as numbers. The 5 on the keypad is the centre of a logical cross-shaped cursor-control pad accessed using the shift key or Ctrl.

The oddest thing about the keyboard is the use of two extra Return keys labelled S1 and S2. They are really function keys and their use varies. In Oliword, S1 becomes Cancel and S2 an auxiliary key for special commands. It is a moot point as to whether this is more trouble than it is worth, as the use is not consistent from package to package.

The keyboard layout is standard English with a £ over the figure 3 and " over the 2. The colon and semicolon are on adjacent keys, which is quite useful. The most inconvenient thing is the lack of an Inst Del, Cancel or simple Backspace key. Deleting a letter means pressing Ctrl-H, which is not a particularly friendly idea.

The screen is very convenient and can be turned or tilted to suit. It has only one control, a brightness adjustment, but the contrast is excellent. The character set is very legible and program lines are well-spaced in Basic, which makes programming a pleasure.

The only flaw was that the cable connector was a loose fit and kept popping out of the console. Also, in certain positions, the fan inside the console would produce a vibrating resonance with the VDU — annoying, but curable by moving the VDU slightly. This is not a problem that has been noted on any other sample of the M-20, and could be due to the unit having been frequently transported.

A colour monitor is also available. It involves the use of one of the expansion slots, and reduces the amount of RAM that can be plugged into 192K.

The Basic-8000 Rev. 1.3 supplied on the system disc appears to be an Olivetti product. However, it is very close to the *de facto* MicroSoft standard — it could well be MicroSoft 5.2 — and offers the same type of string handling — Mid$, Left$ etc.

Commands include TROn and TROff, Auto for line numbering and Renum for renumbering. And it renumbers Gotos and Gosubs. Statements include Def FN, If-Goto-Else and If-Then-Else, Print Using, Swap, On Error Goto and While-Wend. For graphics and screen handling, statements include Circle, Color, Paint, Scale, Window and Close Window.

Scale enables you to switch between a display mode of 64 characters by 16 lines Scale 0,511,0,255, and 80 by 2 — Scale 0,479,0,255. Scale also enables you to set the screen according to your problem co-ordinates, so you can graph things without working out the number of pixels and translating each time.

The only bad thing about the Basic is the error-checking and report, which is only slightly better than PCOS. Errors are not picked up on line entry, and this is a facility which it is unpleasant to live without once you have become used to it. Error reporting is then on the level of

Syntax error in 35

— your problem, mate. You find it.

Editing is not bad, but not everyone will like it. When the program run throws up an error, the line number is reprinted at the end of the OK prompt. Pressing the space bar then prints out the line, so you can edit it. It saves retyping, but at this point Basic turns nasty. If you want to delete characters, use Ctrl-X; if you want to insert characters, that needs Ctrl-I, if you want to extend the line, that needs Ctrl-X.

If you want to delete the rest of the line then enter the Insert mode, use Ctrl-H — H for hack. And so on and so on, over five pages of the manual. Unfortunately you cannot simply use the cursor-control keys

(continued on next page)

OLIVETTI M-20

(continued from previous page)

to zip up the screen to insert that missing colon or whatever. You have to do it the hard way. It may be good for the soul but it is not good for the temper.

Standard benchmark tests reveal that the Basic is extremely fast at executing the trivial tasks they cover. In practical use, however, the Olivetti does not seem subjectively as fast as, say, the BBC Microcomputer, because disc access appears relatively slower.

The Olivetti supplied for review came with two standard packages: the Oliword word processor, and the popular Multiplan spreadsheet — thankfully not rechristened "Olicalc".

Oliword seems to be unique to Olivetti. Many people like it a lot, but this reviewer is not one of them. As with editing in Basic, it is tedious to actually do anything with it. It is somewhat like WordStar, and the editing is about as horrible as Apple Writer II.

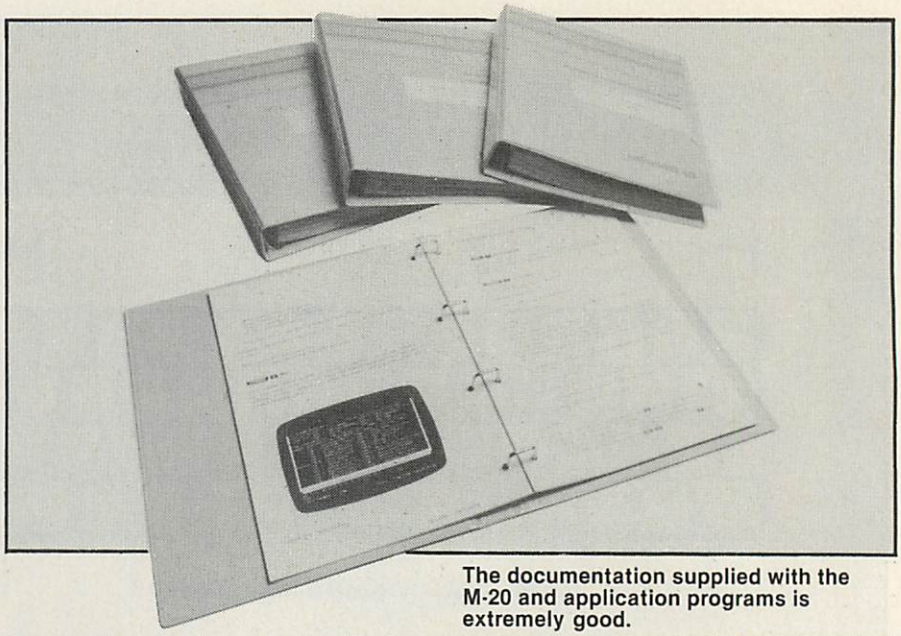
On screen the top nine lines are normally devoted to instructions and function menus. The bottom five lines are devoted to mode, text and system information. This leaves a narrow strip of only nine lines across the middle where you can actually write. A word processor ought either to be as common and familiar as WordStar, or much better. Oliword is neither.

Multiplan seems to be the big software hit of 1983. Practically every major company is implementing this Microsoft program, including IBM, Wang, Apple, Philips and 20 others. It is easy to load by entering mp and pressing Return. After the Olivetti copyright — no mention of Microsoft — the blank spreadsheet appears.

To be different from VisiCalc, commands are entered at the bottom of the screen, using the first letter of any of the 20 options displayed. The initial grid is seven columns by 20 rows. And here is the worst thing about Multicalc: both the columns and rows are numbered, instead of one being numbered and the other lettered. This is because there are 63 columns and 255 rows but only 26 letters in the alphabet — a fact for which one cannot blame MicroSoft. Still, so many people confuse rows and columns anyway, a different notation would help.

One of the many nice things about Multiplan is that it continuously updates a "percentage free" total at the bottom of the screen, so you know when a model is becoming dangerously complex. It has many others, but they are not specific to the M-20, where the program — again, subjectively — does not seem to run quite as fast as on the Wang Professional micro.

As with Oliword and PCOS, Multiplan comes with a template that slots in above the keyboard and makes it convenient to use the Ctrl and CMD function keys to use the top row as function keys. Functions offered include page movements, word and character movements, Delete and Recalc. Thus Olivetti has not simply implemented Multiplan, but has configured it to use the somewhat limited 72-key keyboard to the full.



The documentation supplied with the M-20 and application programs is extremely good.

Olivetti produces an application guide which lists a large number of other programs of various types. Many are general accounting packages, but some are specialised such as Hotel Billing, Kitplan and Kitcost for kitchens, Windows and DGlaze, Newdist for newsagents and QSuite for Quantity Surveyors. The Olivetti range includes Olientry for data entry, Olispec accounting, Olisort, Olistat, Olimaster and Olitutor. This last named is a self-teaching guide to the M-20 itself, and probably well worth having.

The documentation supplied with the M-20 and application programs is extremely good — certainly among the best there is. It is thorough, well laid out and reasonably accessible. It is aimed at the absolute beginner, which makes it slow and somewhat frustrating for the slightly more knowledgeable. The user who knows, say, CP/M or WordStar could really do with a quick summary of the essential differences without having to search through dozens of pages that explain, in great detail, what everything means.

Pocket reference guides are included with the main manuals, but they are not quite as accessible as the manuals themselves — which defeats the whole purpose of having them. The Oliword quick reference card is good; the Multiplan one incomprehensible. Fortunately Multiplan itself has a good Help facility.

In the main manuals, cross-referencing is excellent but of the four supplied, three lacked an index. With such massive and detailed manuals, an index is a real help.

Conclusions

● The Olivetti L1 M-20 is attractively styled, solidly constructed and easy to install.

● It uses an idiosyncratic operating system, PCOS, which is not likely to prove a strong attraction either to complete beginners or to those familiar with CP/M. With CP/M-86 available and a CP/M-80 emulator it would become a more attractive system. Running only under PCOS it will not attract in numbers the business user who is also a computer enthusiast.

● The Basic is fast, but the amount of RAM free to Basic is disappointingly small. The advantages of having a 16-bit machine are by no means obvious from the M-20.

● The ergonomics are good and the screen display is excellent, but the built-in keyboard, while no disadvantage in a laboratory or factory, makes the machine intrusive on an office desk top.

● The documentation is excellent and makes the machine suitable for a complete beginner. However, a beginner would probably be better off, in the long run, learning on an industry-standard operating system such as CP/M-86 or MS-DOS.

● The M-20 could be very attractive to systems houses writing turnkey packages: Olivetti will sell the machine effectively and support the hardware but the software market will be less competitive than for more popular micros such as the IBM PC and Sirius 1. Any software will need to insulate the inexperienced user from the machine.

● At £2,395 plus VAT for the twin-floppy version, the price is competitive. A single-floppy and hard-disc versions are also available.

● The Olivetti L1 M-20 is distributed by Olivetti, Olivetti House, PO Box 89, 86/88 Upper Richmond Road, London SW15 2UR. Telephone: 01-785 6666.

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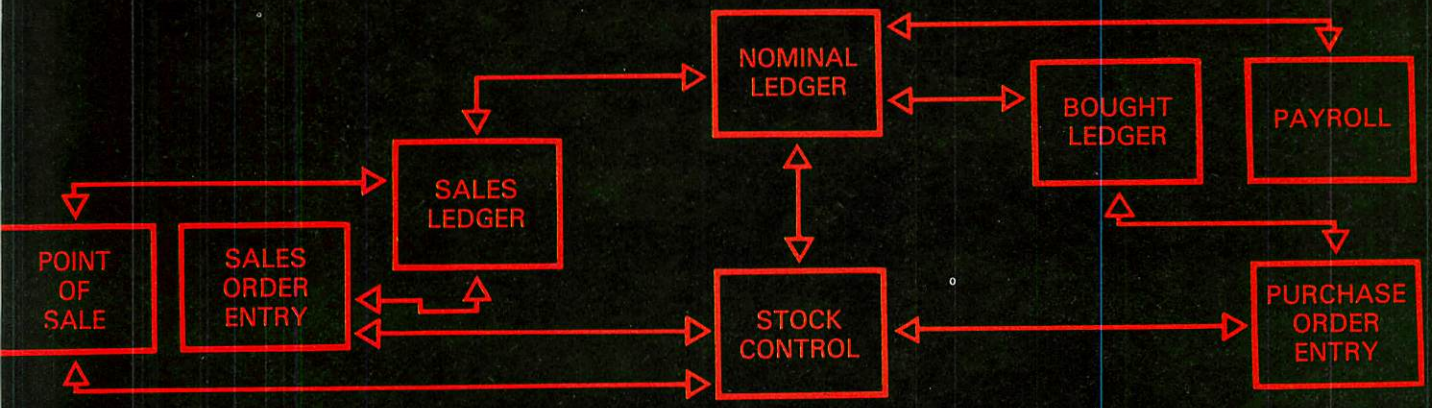

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ORIC 1

Colour, good sound and a price of under £100 make the Oric an attractive beginners' micro.

THE LAUNCH of the Oric 1 comes at a watershed in the development of the micro industry's private subset of English, a language which is called computerspeak. Computerspeak — or if you're really on the ball, ComputerSpeak — has been developed by the people who write press releases, advertising copy and brochures.

It is a language where horrible grotty keyboards are described as "professional"; where £99 microcomputers can be used by businessmen; and where delivery in 28 days means we might get round to sending you a machine one day, but in the meantime we will hang on to your money.

To be fair to the grey faces behind the Oric, they didn't invent Computerspeak. They are, nevertheless, proficient in its use. The Oric looks horrible, which in Computerspeak translates as "superb styling". It does not have a proper keyboard, which is described as "professional". The "comprehensive" user manual is, in fact, impenetrable, and the review machine was supplied with a provisional manual which for a large part was actually wrong.

I could go on, but it would be unfair. Other micro manufacturers are just as bad, but the Oric tops them all by claiming to be "the real computer system". In fact it is a toy.

If the Oric is treated as the toy that it obviously is, it is terrific, except for one thing: the colour does not seem to work on the *Practical Computing* television. These "problems" will be ironed out, says Oric. In fact the new manual is already being sent out, and at least it is correct. Oric says that an adjustment has been made to the TV modulator — which incidently is unique in that it can be programmed — which will result in crisp, sharp pictures on U.K. television sets. A second sample we obtained did, in fact, give bright, attractive colours.

The Oric, though ugly, is very sturdy. It will be able to take the kind of thumping that is commonly associated with micro-computer games. The keyboard, though in no way professional, is vastly superior to that of the Spectrum, which is the Oric's nearest rival. The keys actually depress, but unlike those on the Spectrum they don't make your flesh creep when you touch them. The keyboard is laid out like a typewriter keyboard, with a space-bar and cursor controls in sensible places.

This means that a home computer user could use the Oric as a cheap word-processor, as long as he does not actually know how to type. The keys are more like buttons, and need a firm press. Also they are very small. However, they are suitable for use by a slow two-finger typist.

When each key is pressed it makes a loud blip. This very quickly becomes irritating but it can be turned off by pressing a control character.

There is a word-processor package for the Oric which is due to be released shortly. Designed by John Dawson, it should be usable by a student or a child learning about these matters, and suitable for limited home use.

There are four pads under the Oric, to stop the micro from scratching the kitchen table. They also stop it from sliding about.

In addition to a TV output on the rear of the Oric there is a monitor output. This is strange in two ways. First, it has non-standard pin-configuration. Second, who in their right mind would want to pay £200 for a colour monitor when their micro is only worth £99? There might conceivably be a point if the screen resolution warranted it, but that is not the case with the Oric.

Adding a monitor output costs the manufacturer very little, and so the machine might be no cheaper without it, but it is really only a cosmetic addition. Next to the monitor port is a cassette/sound output port. In fact the loudspeaker built into the Oric is loud enough on its own, but some music or sounds might be wanted for sound effects elsewhere.

Still, being able to take sound from the machine and store it in analogue form on tape just might be a good idea, and it does not cost the manufacturer much to add the facility. The main use of this port is for CSave and CLoad operations to tape. The Oric saves at 2,400 baud, with a 300 baud option for greater reliability. Saving the screen contents or machine-code routines is commendably straightforward.

Next to the cassette/sound port is a 20-pin parallel printer port. It should make adding a Centronics-type printer a comparatively simple task. The Oric does not have an

Specification

Microprocessor: 6502
Memory: 16K or 48K
Keyboard: 57 push-button keys
Sound: three channels across six octaves plus games sounds
Colour: eight colours
Display: 40 characters by 28 lines; high resolution, 240 × 200 points
Ports: TV, RGB monitor, cassette/sound, printer, expansion port.
Price: 16K, £99.95; 48K, £169.95.
Manufacturer: Oric Products International, Coworth Park Mansion, Coworth park, London Road, Sunninghill, Ascot, Berkshire SL5 7SE.

RS-232C compatible port and this is a shame. After all, RS-232 is a fairly standard serial port, and it would be more use than a colour-monitor output to the majority of users.

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The graphics on the Oric were difficult to use, and the manual did not help much either. The difficulty may have something to do with Oric's Prestel adaptor origins. Although the graphics are fast, there is not much that can be done with them, and compared with other micros they are not very powerful.

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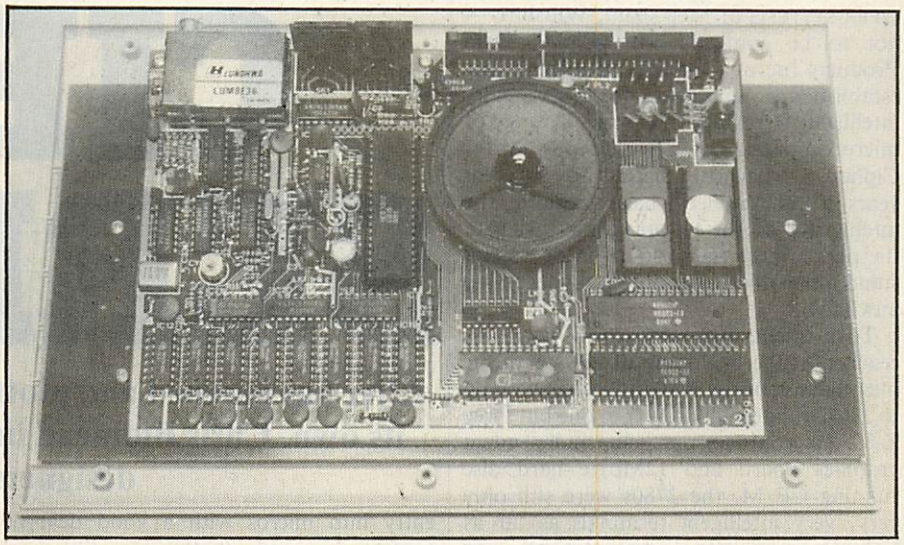

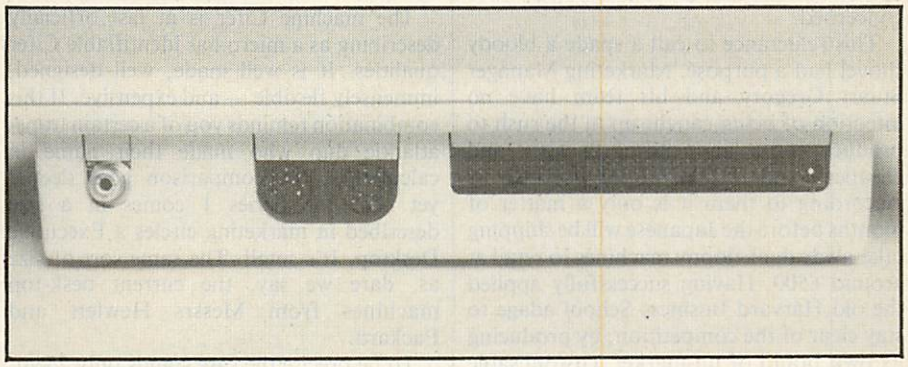

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Conclusions

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However well the contents stand up to scrutiny, in practice you need three hands to hold it open. The whole 3kg. of manual bulges out of the standard Cifer floppy cardboard cover, its uncountable and unnumbered pages held together with a twopenny wire clip. I give it three for presentation, nine for content and a big round zero for star quality.

The hardware itself is a quite different proposition. It looks, feels and even smells like a star. The keyboard has a slightly soft touch that spells luxury, but might take a little getting used to, particularly if you have been brought up on the IBM layout.

I object to the arrangement for repeating characters by way of a separate Repeat key,

Some models include a 10Mbyte Winchester as well as floppies.

which is awkwardly placed between the right-hand Shift key and the Delete key, rather than just holding down any old character you want to machine-gun across the screen. There is a perfectly respectable reason why Cifer does it this way — it minimises the demands made on the central processor in multi-user environments — but if you are used to auto-repeat on every character key you will miss the facility. If you buy a Cifer, a separate repeat key is what you get, but keyboard design is important, at least until voice entry comes along and offices are filled with the sound operators shouting at their screens, trying to nudge cursors to the right position: "Left a bit, bit more, now down . . . "

On the positive side the Series 1 keyboard is very reconfigurable indeed. There are only three function keys as such, but the whole top row of 20 keys, dedicated to terminal functions like dumping to the printer, local screen editing, toggling graphics and so forth, can have alternative user functions downloaded into them, as can the right-hand numeric keypad and its associated cursor keys.

The display is a pale, rather acid green with clear, stable characters that are very easy on the eye, though the size of the screen struck users in this office as not really suitable for sustained use through the working day. Matters are not helped by a slight tendency for the image to jolt when the adjacent Winchester hard disc whirrs into action.

One very useful feature is the ability of the internal screen memory to hold seven screenfuls of text quite independently of the disc subsystem that drives it. You can scroll back and reread vanished data, or even edit it using the local edit keys and write it back to a file using Pip.

The screen allows several forms of highlighting: inverted, half-intensity, blinking, double-size, underlining and more; and these characteristics can be combined. For general use, in WordStar or the various CP/M Visiclones say, half-intensity in conjuction with inverted video makes a restful way of differentiating sections of the screen.

Additionally, protected fields may be set up that are immune to destruction by the cursor. Data-entry programs that call this feature will have to be specially written; ordinary commercial packages like DataStar have their own way of creating protected fields that do not depend on clever hardware.

Like the 2600 range of terminals — from which the Series 1's features are derived — the screen optionally displays an inverted, low-intensity 25th line that shows the status of the screen subsystem. It indicates such things as cursor position by row and column, data communication speed and protocol with the slave printer, whether the numeric keypad has been switched to its alternative function key mode, and so forth. Unlike the 2600 terminals the screen intensity can be changed through dialogue with the status line. A simple escape sequence directed at the screen is all that is necessary to dispose of this line, or replace it with a programmed message.

But this is only half the story as far as the screen is concerned because the physical display can also be driven simultaneously from the graphics board. Two games supplied to demonstrate this feature are downloaded from the disc system. The graphics is high resolution, smooth and fast, and can overlay pictures on the screen text quite independently from the disc subsystem.

The screen facilities are illustrated rather usefully by a Cifer program called &GClock, which sets and maintains a moving representation of an analogue clock-face. The intensity of the picture can be dimmed to background level and be left to tick away the seconds to the next coffee break while WordStar, directories or whatever go scrolling by.

The 256K of internal RAM on the main processor board presented somthing of a puzzle at first, as none of the software that came with the machine was able to access it. The documentation that arrived later explained all: Cifer has its sights on MP/M and CP/M 3, to be launched shortly by Digital Research as CP/M Plus.

Cifer's implementation of MP/M exists already, although we were not able to test it, and here the 256K of RAM is bank switched in 48K segments in the conventional way, with bank-identifying values being sent to a control port. In many respects the RAM behaves just as if it were so many separate S-100 boards. But the configuration is softer than this: a 256-by-eight static-RAM chip maps the memory area into 32 2K blocks, allowing software-changeable bank sizes and the possibility of write-protecting areas of memory.

There are five boards in all. A sandwiched pair comprise the disc subsystem that looks after the Teac and Rodime drives, and three other cards contain the screen system, the main CPU electronics and the graphics components.

There are a lot of chips — we counted 150 and then gave up. All those on the the main boards are socketed rather than soldered in, an expensive construction method adopted by manufacturers who take servicability seriously. I regard it as a mark of high-class merchandise. Other Cifer products show the same fondness for socketing.

The memories are state-of-the-art Texas

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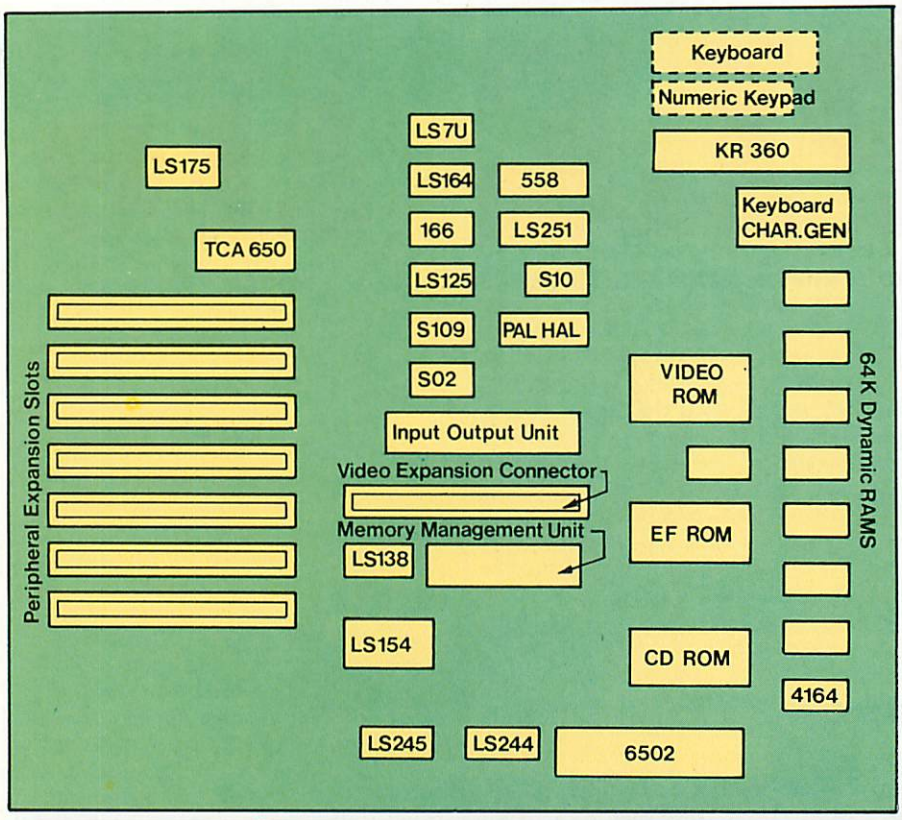

APPLE

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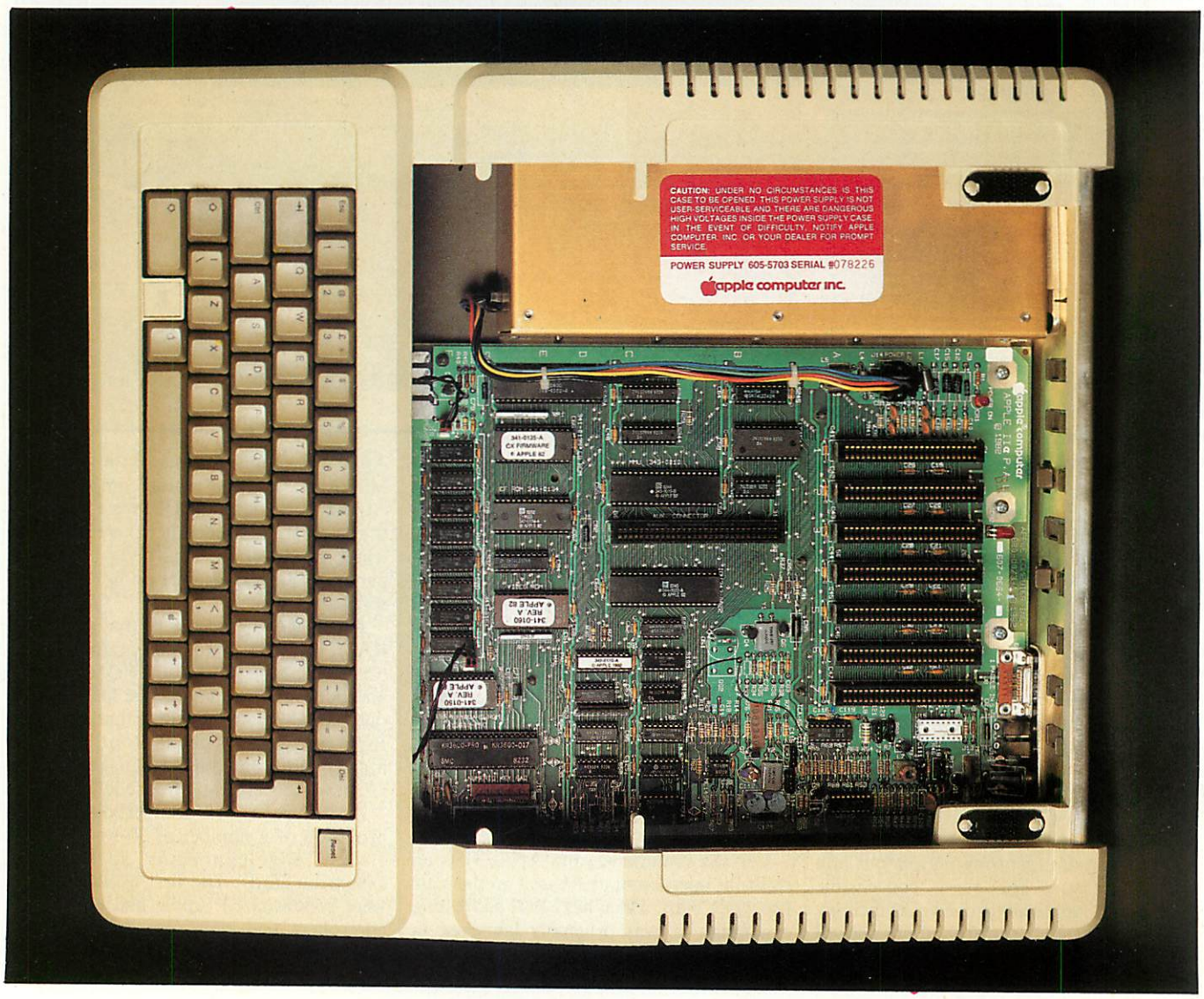
oped other devices — ranging from the esoteric exemplified by the Mountain Hardware Supertalker, the Heuristics Speech Recognition Card and the Alpha Syntauri synthesiser, to more general applications including Modems, buffered printer drivers and 80-column monitor display controllers. Several manufacturers have produced cards with alternative processor chips, using the Apple's 6502 for keyboard, I/O control and other housekeeping duties. The most significant of these are Z-80 boards, which enable Apple users to run the CP/M operating system and hence make available an extensive range of applications software.

From the outside the IIe could easily be mistaken for an Apple II. The case is the same both in size and shape, and the colour is virtually identical although the keyboard is lighter. It is the keyboard that provides the first indication that there is a different beast beneath the outer skin. The space bar is shorter and several new keys have appeared.


CAUTION: UNDER NO CIRCUMSTANCES IS THIS CASE TO BE OPENED. THIS POWER SUPPLY IS NOT USER-SERVICEABLE AND THERE ARE DANGEROUS HIGH VOLTAGES INSIDE THE POWER SUPPLY CASE. IN THE EVENT OF DIFFICULTY, NOTIFY APPLE COMPUTER, INC. OR YOUR DEALER FOR PROMPT SERVICE.
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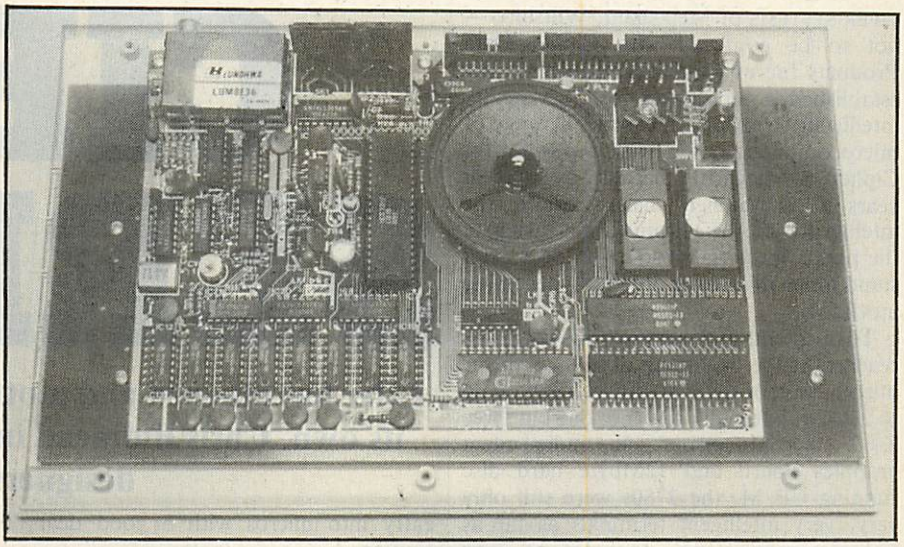

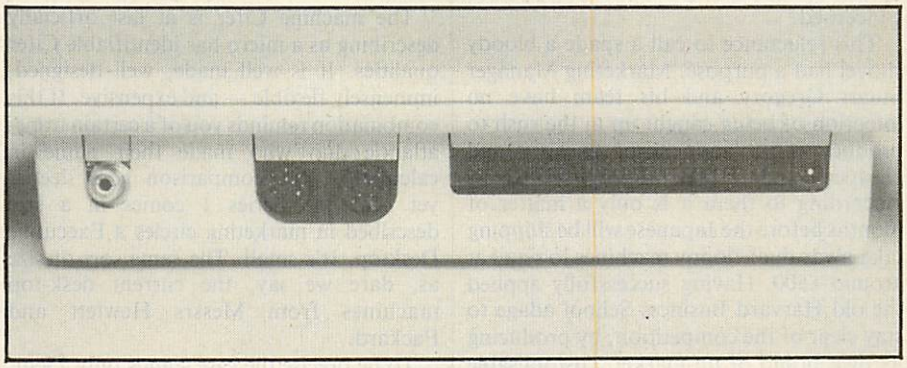

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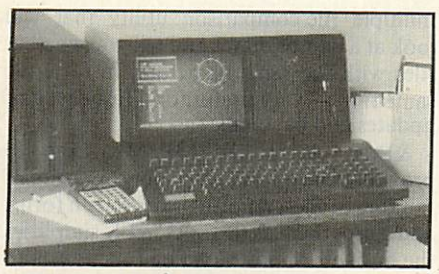
The manual that arrived with the machine, intended for OEM's and development houses, is a formidable three days had study. Readability is not helped by it being an update, complete with insert pages and emendations, of the documentation for the 2680 range of machines. Like other Cifer documentation is it printed in dense dot-matrix format that suggests the rough draft of a Russian novel.

Overcome this initial impression and you will find the manual intelligently sectionalised, with detailed discussions under clear subheadings followed by tabulated data in appendices for subsequent reference. Tables of contents precede the sections and a comprehensive index brings up the rear. One section provides an overview of the CP/M manuals and offers some useful tips. For example, the standard CP/M utility Ed.Com requires the insert command i to be keyed as lower case, otherwise all subsequent text will be written to disc as upper case, however it looks on the screen. This is not made clear in Digital Research's documentation, so Cifer provides the warning. Would that all CP/M computer manufacturers knew the CP/M software environment this well.

However well the contents stand up to scrutiny, in practice you need three hands to hold it open. The whole 3kg. of manual bulges out of the standard Cifer floppy cardboard cover, its uncountable and unnumbered pages held together with a twopenny wire clip. I give it three for presentation, nine for content and a big round zero for star quality.

The hardware itself is a quite different proposition. It looks, feels and even smells like a star. The keyboard has a slightly soft touch that spells luxury, but might take a little getting used to, particularly if you have been brought up on the IBM layout.

I object to the arrangement for repeating characters by way of a separate Repeat key,



Some models include a 10Mbyte Winchester as well as floppies.

which is awkwardly placed between the right-hand Shift key and the Delete key, rather than just holding down any old character you want to machine-gun across the screen. There is a perfectly respectable reason why Cifer does it this way — it minimises the demands made on the central processor in multi-user environments — but if you are used to auto-repeat on every character key you will miss the facility. If you buy a Cifer, a separate repeat key is what you get, but keyboard design is important, at least until voice entry comes along and offices are filled with the sound operators shouting at their screens, trying to nudge cursors to the right position: "Left a bit, bit more, now down . . . "

On the positive side the Series 1 keyboard is very reconfigurable indeed. There are only three function keys as such, but the whole top row of 20 keys, dedicated to terminal functions like dumping to the printer, local screen editing, toggling graphics and so forth, can have alternative user functions downloaded into them, as can the right-hand numeric keypad and its associated cursor keys.

The display is a pale, rather acid green with clear, stable characters that are very easy on the eye, though the size of the screen struck users in this office as not really suitable for sustained use through the working day. Matters are not helped by a slight tendency for the image to jolt when the adjacent Winchester hard disc whirrs into action.

One very useful feature is the ability of the internal screen memory to hold seven screenfuls of text quite independently of the disc subsystem that drives it. You can scroll back and reread vanished data, or even edit it using the local edit keys and write it back to a file using Pip.

The screen allows several forms of highlighting: inverted, half-intensity, blinking, double-size, underlining and more; and these characteristics can be combined. For general use, in WordStar or the various CP/M Visiclones say, half-intensity in conjuction with inverted video makes a restful way of differentiating sections of the screen.

Additionally, protected fields may be set up that are immune to destruction by the cursor. Data-entry programs that call this feature will have to be specially written; ordinary commercial packages like DataStar have their own way of creating protected fields that do not depend on clever hardware.

Like the 2600 range of terminals — from which the Series 1's features are derived — the screen optionally displays an inverted, low-intensity 25th line that shows the status of the screen subsystem. It indicates such things as cursor position by row and column, data communication speed and protocol with the slave printer, whether the numeric keypad has been switched to its alternative function key mode, and so forth. Unlike the 2600 terminals the screen intensity can be changed through dialogue with the status line. A simple escape sequence directed at the screen is all that is necessary to dispose of this line, or replace it with a programmed message.

But this is only half the story as far as the screen is concerned because the physical display can also be driven simultaneously from the graphics board. Two games supplied to demonstrate this feature are downloaded from the disc system. The graphics is high resolution, smooth and fast, and can overlay pictures on the screen text quite independently from the disc subsystem.

The screen facilities are illustrated rather usefully by a Cifer program called &GClock, which sets and maintains a moving representation of an analogue clock-face. The intensity of the picture can be dimmed to background level and be left to tick away the seconds to the next coffee break while WordStar, directories or whatever go scrolling by.

The 256K of internal RAM on the main processor board presented somthing of a puzzle at first, as none of the software that came with the machine was able to access it. The documentation that arrived later explained all: Cifer has its sights on MP/M and CP/M 3, to be launched shortly by Digital Research as CP/M Plus.

Cifer's implementation of MP/M exists already, although we were not able to test it, and here the 256K of RAM is bank switched in 48K segments in the conventional way, with bank-identifying values being sent to a control port. In many respects the RAM behaves just as if it were so many separate S-100 boards. But the configuration is softer than this: a 256-by-eight static-RAM chip maps the memory area into 32 2K blocks, allowing software-changeable bank sizes and the possibility of write-protecting areas of memory.

There are five boards in all. A sandwiched pair comprise the disc subsystem that looks after the Teac and Rodime drives, and three other cards contain the screen system, the main CPU electronics and the graphics components.

There are a lot of chips — we counted 150 and then gave up. All those on the the main boards are socketed rather than soldered in, an expensive construction method adopted by manufacturers who take servicability seriously. I regard it as a mark of high-class merchandise. Other Cifer products show the same fondness for socketing.

The memories are state-of-the-art Texas

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CIFER SERIES 1

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4164 64K RAMs. The top graphics and disc boards have eight of them each making 64K, and the main CPU board has an impressive four-by-eight array of them, providing 256K in all. Zilog or Zilog second-source peripheral chips — Darts, SIOs, PIOs and DMAs — are used extensively. They support internal data transfer and external transactions though the single IEEE-488 socket for an additional Winchester drive, and the four 25-way D-type connectors at the rear of the machine. One of these, rather confusingly, is actually a Centronics parallel interface; the remainder are regular RS-232.

A fifth rear socket allows extra floppy drives to be daisychained on. As the ability to mix'n'match a very large number of different disc formats is an important feature of the machine, Cifer supplied us with external 8in. slim-line drives housed in a handsome, long black box to supplement the single built-in 5.25in. drive.

Head size on the 8in. drives means that in single-density mode they are only able to read, not write, and there is the obvious physical limitation that the drives require the discs to be soft-sectored. But within these constraints, aided by a Cifer systems utility called &SDef, the machine can handle combinations of 20 different disc formats, including IBM-standard single-density 8in., Superbrain and Televideo.

By tweaking variables in the interface between CP/M and Ciops, &SDef not only alters the disc parameters, but can also juggle with the logical-to-physical mappings. It is up to you, for example, whether drive A: is the hard disc or one of the peripheral 8in. discs.

Two features seem to be missing, however. There is no way of splitting the hard disc into a pair of logical drives — much the best way to handle a 12Mbyte Winnie for most ordinary applications — and there appeared to be no possibility of addressing the same physical drives as different formats under different CP/M drive names. On some systems, for example, the same pair of 8in. drives can be A: and B: and look like standard single density, or be C: and D: in which case they become double density. Format change always has to be made explicitly by way of &Set.

&SDef is one of a number of Cifer utilities that help the user to tap the power of the machine's unusual features. Another is &Veri, a file-compare program that takes the names of two files that may or may not be the same and hex dumps them to the screen a record at a time with the non-matching bytes highlighted; &MVeri is a multiple file-comparison utility that will look at a pair of drives and tell you whether files with the same name are, in fact, the same files — very useful for a fast check of updates and back-ups.

&Eraq works like MP/M's Eraq to provide rapid query and response erasure of families of files. &Form draws screen forms and stores them as text files, &FK simplifies the business of downloading functions into the keyboard, and &Backup in conjunction with &Restore is a Winchester disc back-up utility that is capable of splitting large files between floppies and joining them together again if the back-up needs to be reloaded.

&Set works a little like Stat in its IOByte mode, establishing linkages between logical I/O devices and their physical implementations. But it goes a lot further than the ordinary CP/M utility in offering many more linkage options and fanning out linkages. The LPT: device, for example, becomes two or even three output ports simultaneously, and &Set can change input and output protocols.

&Format, as you might expect, initialises blank discs for use with the system, but turned out to have an odd bug. When formatting a disc in drive B: — the internal floppy in the configuration we were using — this drive became drives A: and B: on existing from the program, and the Winchester could only be accessed by rebooting.

With this minor exception all the foregoing programs worked as documented, but I was not so lucky with &Xfer, which is designed to manage the transfer of text files between machines. I just could not get it to do anything. Cifer says that &Xfer is in its early version, although it is perfectly possible that the problems encountered were hardware bugs in the external non-Cifer equipment, or just stupidity on my part.

Cifer is following a route parallel to Televideo's, from smart terminals to stand-alone micros, but its software department has clearly been keeping abreast of things. With these additional &*.Com utilities Cifer's implementation of CP/M matches the very high quality of the hardware.

To balance my enthusiasm for the product as a whole I should list a number of minor dislikes about the machine. To start with the most trivial, although booting up is very flexible — W to boot on the Winchester; 0,1,2, or 3 to boot on the floppy drives; an empty Return to seek a system on each of the drives in turn, and ? for a Help screen to explain the booting procedure — there is a silly inconsistency: the W requires a Carriage Return.

The excellent Rodime drives occasionally give out a bright chirruping sound that would be good news from a canary, but sound to anyone with an ear for machinery as if a bearing is about to burn out. It isn't and doesn't, in fact, and the sound soon goes away again. I've noticed the same effect in other Rodimes in other machines, and I suppose it's no more than resonance in the casing.

My biggest, though still minor objection is that the clever "operating system within an operating system" idea slugs Winchester disc access time. Subjectively it seems to be something like twice to three times as slow as I have become used to on an almost identical Rodime drive in the Almarc Series 8. Admittedly the Almarc machine does not allow the sophisticated route mapping of the Cipher, but I would be inclined to trade speed for sophistication for the applications, which are mostly text manipulation, that go on in this office.

A partial answer is provided by Cifer in the shape of a number of alternative CP/M implementations of various sizes and smartnesses, offered as Sysgenable files. Only one of these smaller and faster alternatives supports the Winchester. It offers a 53.75K TPA as opposed to the 50.75K TPA of the full CP/M version, but sacrifices the ability to switch the disc formats or alter the external port baud rate. It also eliminates the Centronics port, and is still noticeably slower than the uncluttered Almarc implementation. But if you are used to floppies the Cipher is still very fast.

Conclusions

- **This computer is a very compact and extremely comprehensive eight-bit machine. The screen size is probably too small for day-long work, but outputs are provided to other terminals or to a video display.**
- **It comes with CP/M in several sizes, offering access to a great deal of commercial software. But essentially CP/M acts as the outer shell to the hardware-dependent Ciops operating system with some overhead in speed of execution.**
- **The provision to read and write to a variety of different disc formats makes it a useful machine for software houses. Unfortunately the configuration we tested was not able to write to 8in. discs in single-density format.**
- **It is made in the U.K. and Cifer is in a position to offer excellent support.**
- **The Cifer Series 1 is a beautifully made, beautifully designed eight-bit machine.**
- **For information contact Cipher Systems. Telephone: Bath (0225) 706361.**

Series 1 systems

Model 1886: two 5.25in. floppies, 64K RAM, CP/M 2.2, price £2,795.

Model 1887: one 5.25in floppy, one 10Mbyte Winchester, 128K RAM, CP/M 3, IEEE-488 interface, price £4,995.

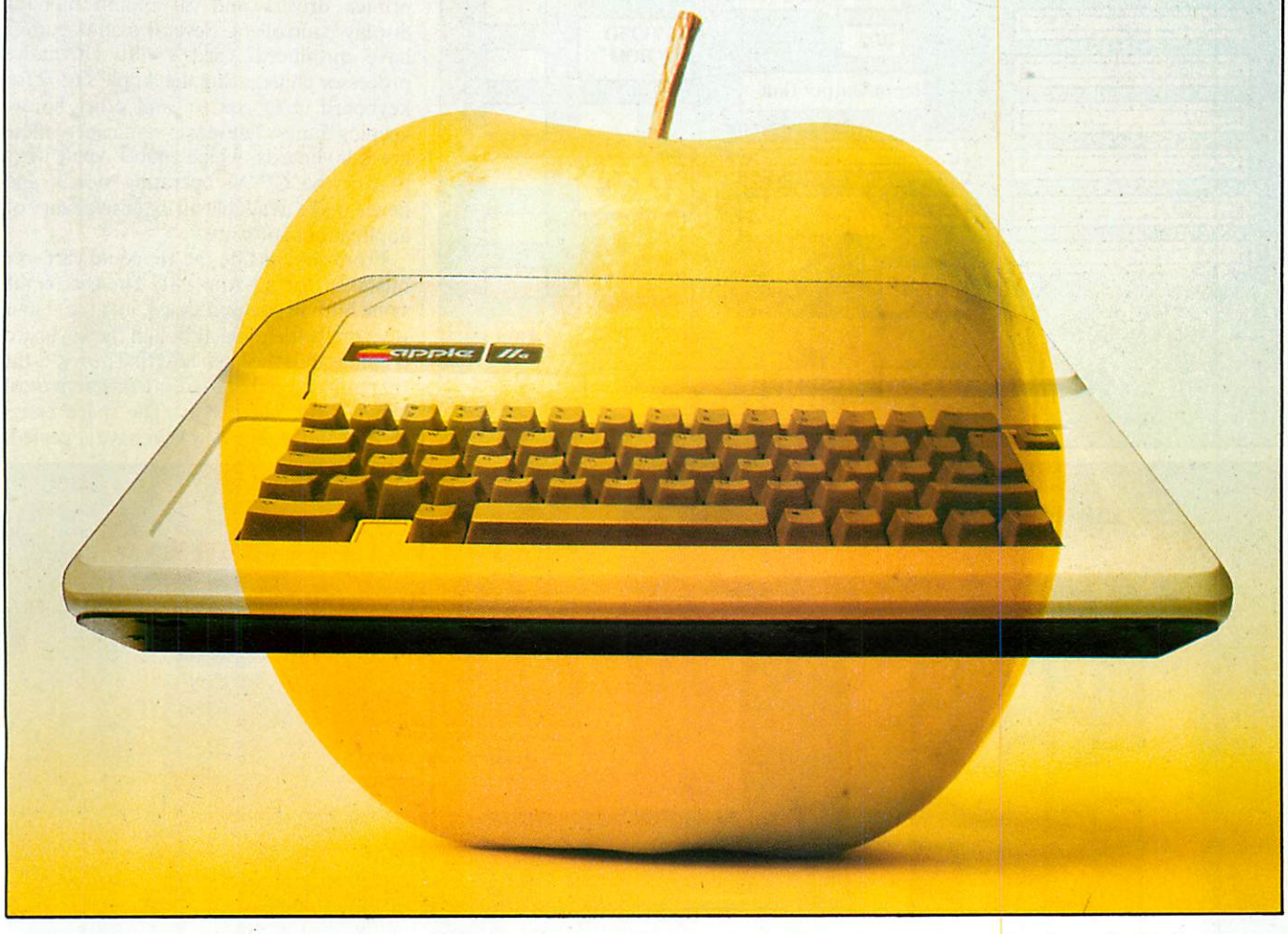
Model 1888: three 5.25in floppies, 64K RAM, CP/M 2.2, price £3,245.

Model 1889: as model 1887 with one extra floppy, price £5,395.

High-resolution graphics, extra RAM, MC-68000 processor, 21Mbyte Winchester, MP/M and Unix are all available as options at extra cost.

APPLE IIe

The old workhorse lives on in a new incarnation. Roger Cullis put it through its paces.



DURING THE LAST year or so manufacturers have used developments in microcomputing technology to give us more powerful machines at the same price as a standard eight-bit, 64K computer. The ACT Sirius and the IBM Personal Computer and all its look-alikes, have been made possible by increased packing density and the increased complexity of chips. Apple, instead of jumping on the 16-bit bandwagon, has applied the improvements to a well-tried and successful formula. The result is the Apple IIe, best described as a state-of-the-art Apple II.

Over half-a-million sales demonstrate that Apple got it right the first time. The product spawned a whole satellite industry engaged in manufacturing peripherals and writing software for every conceivable application. Apple has proved convincingly that software sells hardware and will also sell peripheral hardware designed for special purposes. With a ready-made base of applications packages there was no reason to break new ground.

It is apparent that Apple has gone to great lengths to ensure that the new computer is compatible with its predecessor, even to the extent of perpetuating hardware compromises which are a legacy from the days when 4K RAM chips cost as much as 64K chips do now.

Apple has drastically reduced the number of chips, a factor which will both increase reliability and ultimately permit a significant reduction in the selling price. New features such as built-in diagnostics, lower-case text and extra cursor controls make the IIe even more attractive to the business user.

For the uninitiated, the Apple II is an eight-bit microcomputer based on the 6502 processor chip, which has a 64K addressing capability. It was originally launched in 1977 with a rather limited integer Basic interpreter. Subsequently it was replaced by Applesoft, a floating-point Basic written by Microsoft. Versions of the computer with Applesoft resident in ROM were known as the Apple II Plus. Since then there has been a whole range of internal revisions, transparent to the user as they do not affect his software.

A 16K RAM card means that additional RAM, mapped into the address space occupied by the interpreter ROM, permits an additional language to be loaded from disc. An alternative Basic to that present in ROM is provided as standard on the Systems Master Disc, but other languages such as UCSD-p and Fortran are also available.

A feature of the motherboard is the provision of a number of 50-way printed-circuit edge-connector sockets for expansion cards. The first available cards were produced by Apple and added disc controllers and serial/parallel interfaces. Independent manufacturers quickly devel-

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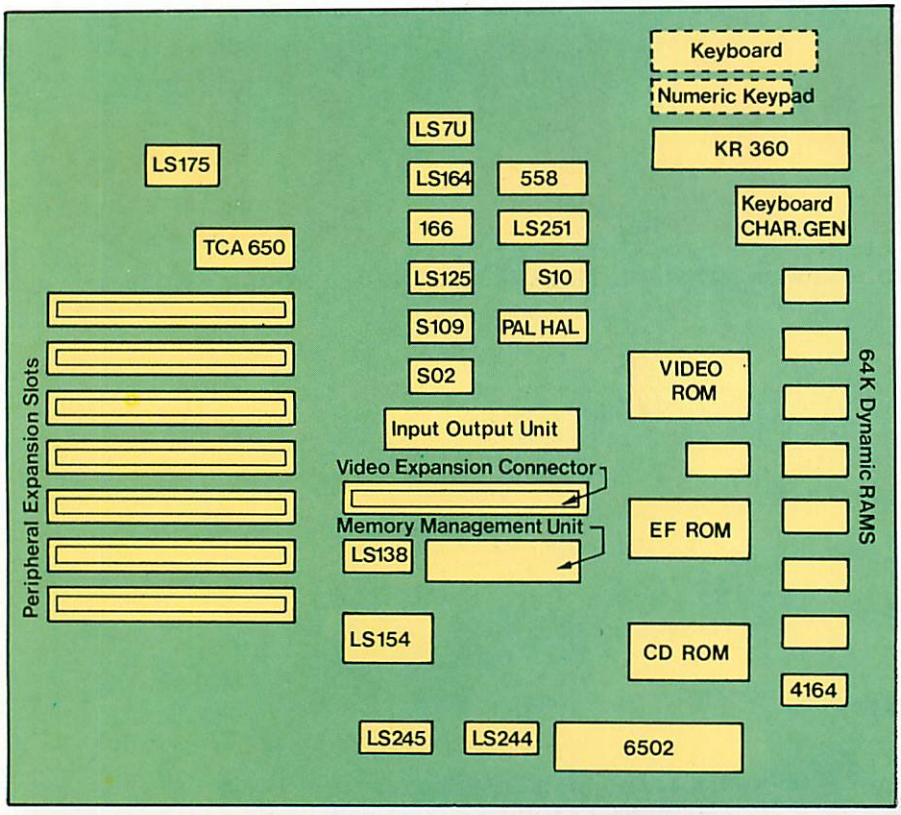

APPLE

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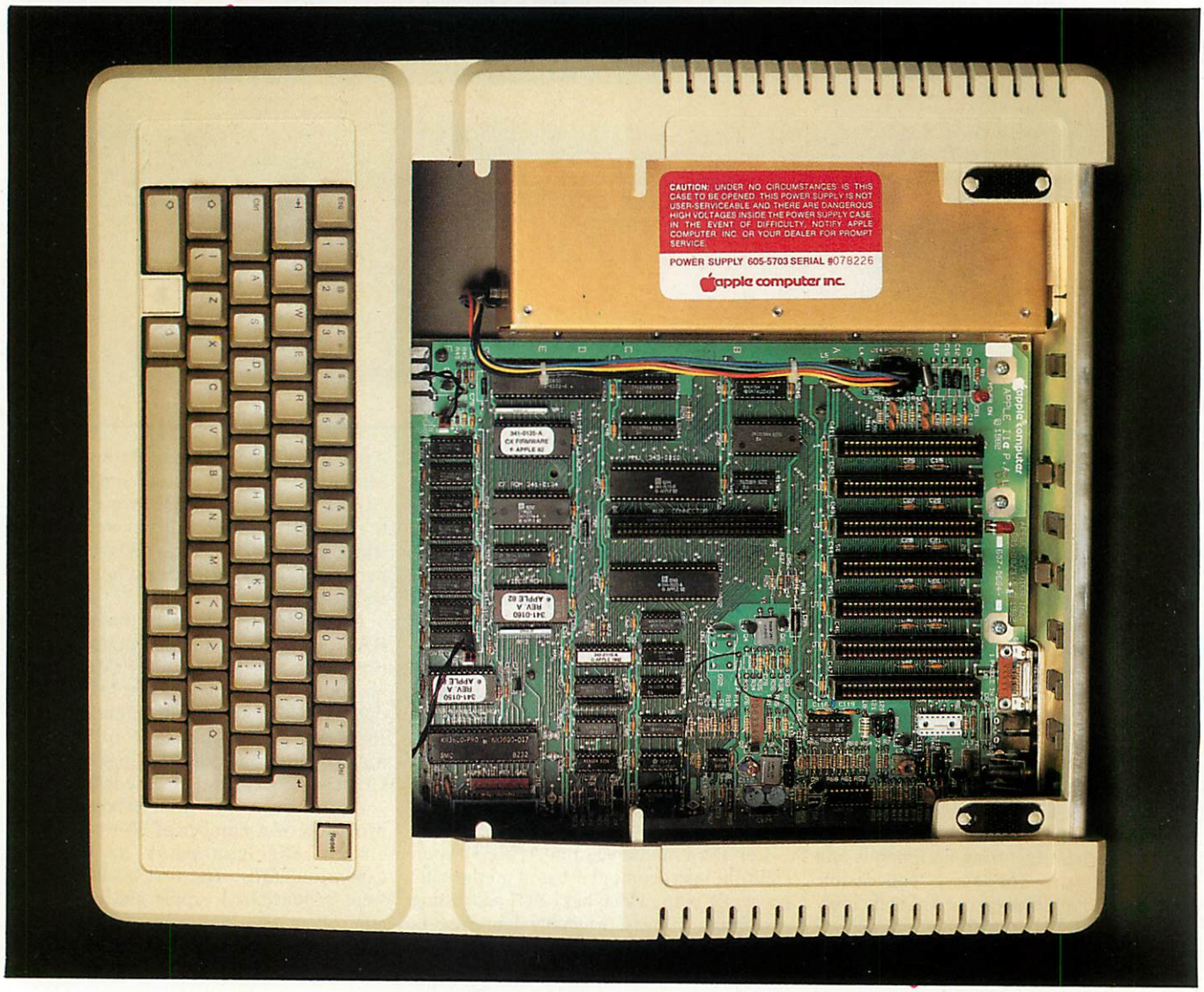
oped other devices — ranging from the esoteric exemplified by the Mountain Hardware Supertalker, the Heuristics Speech Recognition Card and the Alpha Syntauri synthesiser, to more general applications including Modems, buffered printer drivers and 80-column monitor display controllers. Several manufacturers have produced cards with alternative processor chips, using the Apple's 6502 for keyboard, I/O control and other housekeeping duties. The most significant of these are Z-80 boards, which enable Apple users to run the CP/M operating system and hence make available an extensive range of applications software.

From the outside the IIe could easily be mistaken for an Apple II. The case is the same both in size and shape, and the colour is virtually identical although the keyboard is lighter. It is the keyboard that provides the first indication that there is a different beast beneath the outer skin. The space bar is shorter and several new keys have appeared.


CAUTION: UNDER NO CIRCUMSTANCES IS THIS CASE TO BE OPENED. THIS POWER SUPPLY IS NOT USER-SERVICEABLE AND THERE ARE DANGEROUS HIGH VOLTAGES INSIDE THE POWER SUPPLY CASE. IN THE EVENT OF DIFFICULTY, NOTIFY APPLE COMPUTER, INC. OR YOUR DEALER FOR PROMPT SERVICE.
POWER SUPPLY 605-5703 SERIAL #078226
apple computer inc.

These perform mainly conventional functions such as Delete and Tab or provide ASCII characters like | and [, which were not present on the original Apple II, but two are unique.

At each end of a shortened space bar is a special key, the one on the left bearing an outline Apple symbol and the one on the right a filled apple. These keys are connected to one-bit game inputs and can be used as conventional games controls, say, to fire laser cannons or more mundanely in a custom graphics program to switch to an alternative mode, or make a back-up copy of a high-resolution screen.

When used in conjunction with the Control and Reset keys the open apple initiates a cold boot; the closed Apple starts a self-test using built-in diagnostics routines. If everything is functioning satisfactorily it responds with the message "Memory OK". During the cold boot routine the IIe carries out a partial memory wipe, a feature which has been introduced because many software vendors used it to protect programs run on the II Plus.

Cursor up and down keys have been added, although the Escape commands which perform those functions on the II Plus may still be implemented. The Apple II is gradually accumulating a proliferation of ways of moving the cursor, since the II Plus in turn had inherited four Escape commands for this purpose from the original II.

The Reset key has been moved to a less vulnerable position slightly away from the main bank of keys. It is lower and must be used in conjunction with the Control key to perform a warm boot, in contrast with the original Apple II where Reset could be, and frequently was, operated accidentally. In the later revisions of the II Plus the dual-key operation was an option selected by a switch on the keyboard encoder printed-circuit card.

Apart from the provision of additional characters many of the ancillary symbols have been moved. For example, the inverted commas and the apostrophe have deserted the 2 and the 7 and have joined forces on a new key next to Return, while the & is now to be found above the 7 instead of the 6. It will provide no difficulty for new users or those accustomed to the ISO standard keyboard layout, but owners of the II or II Plus will have to stop and think when they are using a IIe.

Although it is not difficult to make the change there may be mis-keying problems when the IIe is installed beside the old machine. Ergonomically it would be better if the IIe were a different colour, to provide a visual stimulus when changing from one to the other.

Apple could have made more use of the switch which it thoughtfully installed on the underside of the case for selecting the ISO standard or an alternative national keyboard. To cater for the requirements of different languages, there are some 22 different arrangements of the keys, the corresponding character set being defined by a ROM on the motherboard. It would presumably be a relatively simple matter to emulate the layout of the II Plus as the alternative character set.

The Repeat key has disappeared. All of the keys now have auto-repeat — a welcome improvement.

The previous Apple had a random array of ribbon cables, which meandered from cards in the expansion slots, through slits in the back of the case, to devices such as disc drives and printers which were in separate boxes. Moving the computer was an exercise in logistics, often requiring the removal of peripheral cards. Apart from the damage which could be sustained by the card, particularly those containing MOS chips, frequent removal and insertion of the cards sometimes causes hairline cracks in the motherboard printed circuit — with obvious results.

The IIe has overcome the problem with a new sheet-metal back punched with holes ready to take Cannon D-type and other connector sockets. Peripherals can now be plugged in at will using a robust sheathed cable. If a more permanent connection is desired it can be held in place with retaining screws, which prevent accidental displacement.

On opening the lid the first impression is one of emptiness. The motherboard indicates the changes in semiconductor device technology since the II was first launched. Although with 89 capacitors, six transistors and 43 resistors the discrete component count has not been changed unduly, a mere 40 integrated circuits have replaced the 85 or so chips on the old motherboard.

Nowadays memories are made of 64Kbit or larger dynamic RAMs, so the equivalent of an Apple II motherboard RAM and a 16Kbyte language card is to be found in the eight chips at the bottom edge of the printed circuit. Gone, too, are the D0, D8, E0, E8, F0 and F8 ROM which have been with us in various forms since the beginning.

In their place are three large 2364 ROM chips: the Memory Management Unit or MMU; the Input/Output Unit or IOU — no cracks about cycle stealing please; and Programmed Array Logic or PAL — not to be confused with the European standard colour TV circuits which are elsewhere; and two smaller ones, the keyboard decoder and the character generator. For the decoder a 2316 suffices, but for the character generator a 2332 has been chosen to permit straight-through bit-mapping for the graphics modes, but avoiding the need for additional switching circuitry.

The keyboard has no piggyback encoder PCB, but is connected directly to the motherboard via a ribbon cable and 25-way connector. A useful new feature is provision for the connection of a numeric keypad, an optional extra. With a basic microcomputer like the IIe, this increases the flexibility of the machine and is in keeping with the modular approach which Apple has adopted. Here it is particularly convenient because the keypad can be customised for a specific application, such as VisiCalc or word processing.

It is even feasible to plug in different keypads on different occasions, and we may expect to see peripheral suppliers including a keypad as well as a disc and expansion card with their applications packages. Full upper and lower case are present, but the Apple II can be emulated using the Caps Lock key.

The other internal change which is immediately apparent is the translation of slot 0 to a different position. In the process it has gained an extra 10 connections and has been renamed the video expansion connector. Slot 0 was the traditional home of the Apple language card, but since in the IIe the extra 16K is now provided in the motherboard RAM, its main purpose has disappeared.

Apple has made provision for an 80-column display by launching a new 80-column text card and an extended 80-column text card, either of which plugs into the video expansion connector. The two

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Specification

Microprocessor: 6502A eight-bit data, 16-bit address bus
Operating system: Apple DOS 3.3
Memory; 64K dynamic RAM, 16K bank-switched with ROM
16K ROM
additional 1K RAM with 80-column card
additional 64K RAM with extended 80-column card
Disc storage: single-sided, soft-sectored 143K per disc
two drive-controller card plugs into expansion slot.
Keyboard:
ISO standard with 63 keys
optional plug-in keypad
Display:
40 character x 24 lines text
80 character x 24 lines text with 80-column card
40 x 48 pixel 16-colour low-resolution graphics.
192 x 280 pixel six-colour high-resolution graphics
192 x 560 pixel six-colour high-resolution graphics with optional 80-column card
Dimensions: height × width × depth
100 × 385 × 450 mm
Prices:
Apple IIe with 64K RAM, £845
80-column card, £80
extended 80-column card, £180
disc drive with controller card, £345
dot-matrix printer, £425
daisywheel printer, £1,350

APPLE

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cards simply add 80-column text display and, unlike existing pripheral cards such as the Screen-Master 80 or the Comms-Master 4880 which plug into slot 3, do not support high-resolution graphics or terminal emulation.

When either of the 80-column cards is installed in the video expansion connector, it is not possible to use a peripheral card with on-board firmware in slot 3. In 80-column operation a high-resolution monitor with at least 14MHz bandwidth is needed to achieve a satisfactory performance; otherwise it functions in a similar manner to the 40-column text mode. Upper and lower cases in normal and inverse modes are available, but flashing characters are not implemented.

The IIe carries a Pal encoder together with a colour killer switch on the motherboard, which produces an unmodulated signal. To drive a television receiver it will be necessary to use an interface such as the Digitek modulator card, which can be mounted in slot 7 or adjacent to the keyboard ribbon-cable connector.

To achieve software compatibility the organisation of the IIe is very similar to its predecessor, even to the extent of adopting the same idiosyncratic memory map with the high-resolution screen buffers positioned in the middle of the user program space. The processor is a 6502A, clocked at the same rate as the 6502 of the II and II Plus. With an unchanged Applesoft interpreter the performance is identical, as the benchmark comparisons with the latest revision of the II Plus show. The differences lie within the tolerance variations to be expected in the clock crystals of individual machines.

The Monitor ROM has been completely rewritten, but the starting addresses of all the routines remain the same. It means that Basic and machine-code programs for the Apple II, which reference the monitor, will run satisfactorily on the IIe provided that they call the starting address of the sub-routine. But if they jump to an address within the subroutine they will crash.

Provision of 80-column display capability carries with it the need to double the size of the text buffer, because the amount of information displayed on the screen is twice that of the 40-column mode. In the new 80-column card it is achieved by the provision of an auxiliary 1K RAM on the card. The extra RAM is mapped into the same address space, $400 to $7FF, as the existing text buffer Page 1, and is referred to as Text Buffer 1X — the necessary switching of the display being carried out by the MMU. If the relevant soft switch is toggled the 80-column display mode remains, but every other character disappears from the screen.

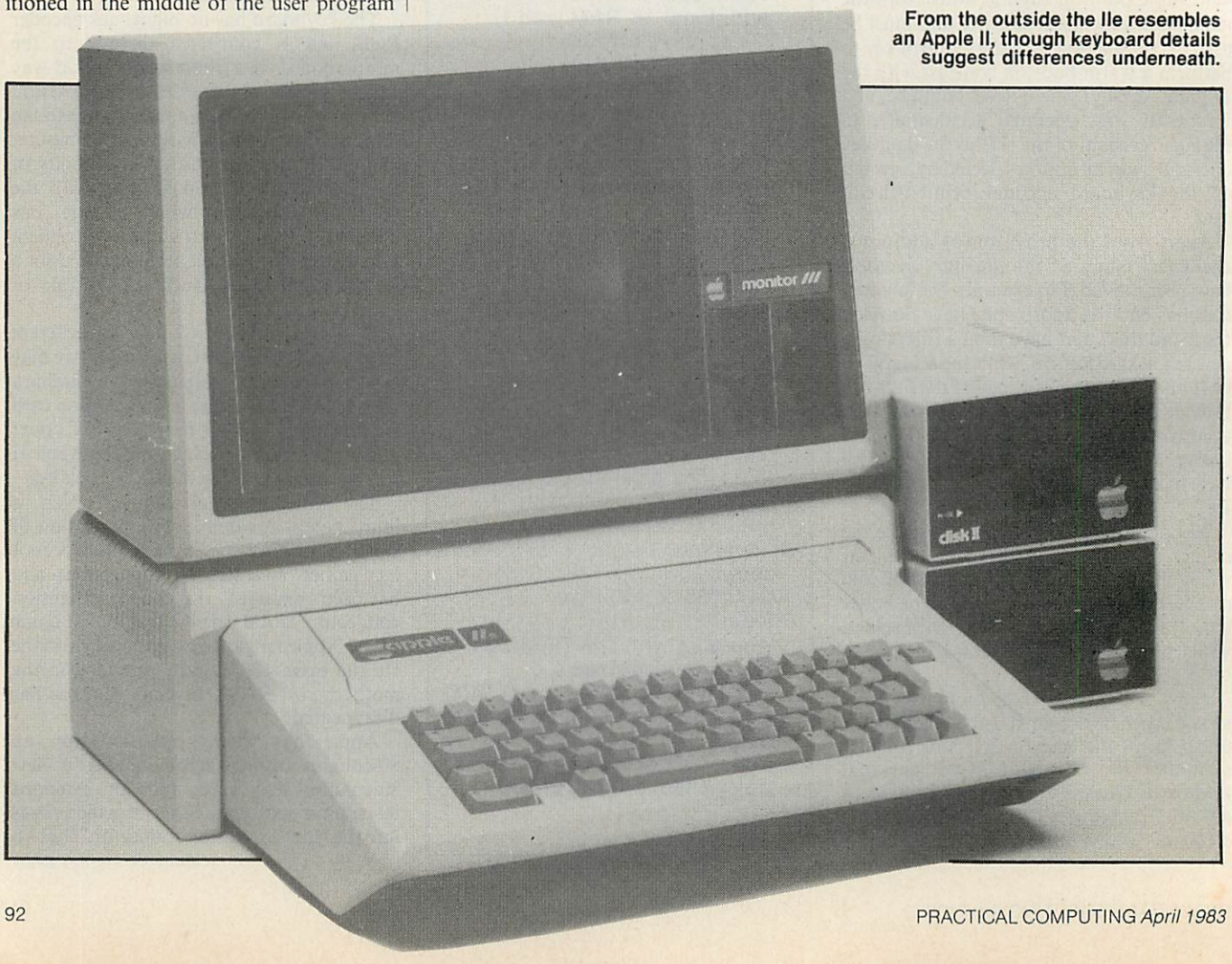
The extended 80-column card carries a complete 64K of additional RAM, which is mapped into the entire address space of the 6502. It provides a complete parallel memory which can be substituted for the main memory by soft switches in the I/O block, $C000 to $CFFF.

With the extended 80-column card it is possible to define an enhanced horizontal-resolution 560-dot high-resolution graphics mode. It uses an auxiliary high-resolution graphics buffer Page IX mapped into $2000 to $3FFF in the auxiliary memory. Current DOS 3.3 and Applesoft do not support this mode — therefore it can only be used at present by machine-code programs.

For switching purposes, the memory map is divided into one small section and two large sections — stack and Page 0, $0 to $1FF; normal 48K RAM, $200 to $BFFF; and bank-switched memory, $D000 to $FFFF. As with current RAM cards, addresses $D000 to $FFFF support 16K banks of RAM. Two 4K sub-banks are mapped into $D000 to $DFFF and read- and write-enabled by soft switches.

As with the II Plus, In/Out functions are controlled by soft switches in the space $C000 to $C07F, but with the IIe certain addresses serve more than one purpose. It is important to distinguish between Read- and Write operations as the effect will be different. Expansion slots have their own dedicated addresses in the ranges $C080 to $C7FF and share the region $C800 to $CFFF.

The existence of two completely parallel sets of memory offers interesting



From the outside the IIe resembles an Apple II, though keyboard details suggest differences underneath.

possibilities for modular programming, but will have to be approached with great caution to ensure that the correct program segments are associated with the correct page 0 and stack. Routines have been provided in the new monitor to move blocks between main and auxiliary memory, and to transfer program control at the appropriate time.

It has only been possible to perform superficial tests on software and peripheral devices. Pascal and CP/M run on the IIe as do a number of major machine-code packages such as VisiCalc. Applewriter II has been re written to accommodate the new 80-column cards, but the existing version works satisfactorily in 40-column mode, or with 80-column cards produced by other vendors when used in conjunction with a pre-boot disc.

VisiCalc takes advantage of the extra on-board memory to permit the construction of larger models. It also works equally well with a variety of other RAM cards, including 128K cards which take their refresh from the motherboard by plugging a ribbon cable into a socket previously occupied by a RAM chip. Apple has also introduced a special version of the multiplan spreadsheet for the IIe.

Conventional Applesoft programs function in exactly the same way as on the Apple II Plus and so do Speed Star compiled programs. Bit copiers such as Nibbles Away II work normally and I ran a program using UBI, universal boot initialiser, which is a non-standard fast-booting DOS. Graphics programs, both in Applesoft and machine code performed in a satisfactory way.

Turning to hardware, I drove an Epson MX-100 printer through a Super Printmaster III parallel interface card in text and graphics modes. A Screen-master 80-column card worked normally in slot 3 using 40- and 80-column text modes and high- and low-resolution graphics modes. A Z-80 Softcard booted up CP/M, but shortage of time prevented thorough exercising. The Double-Time printer which uses a special monitor ROM requires a firmware fix.

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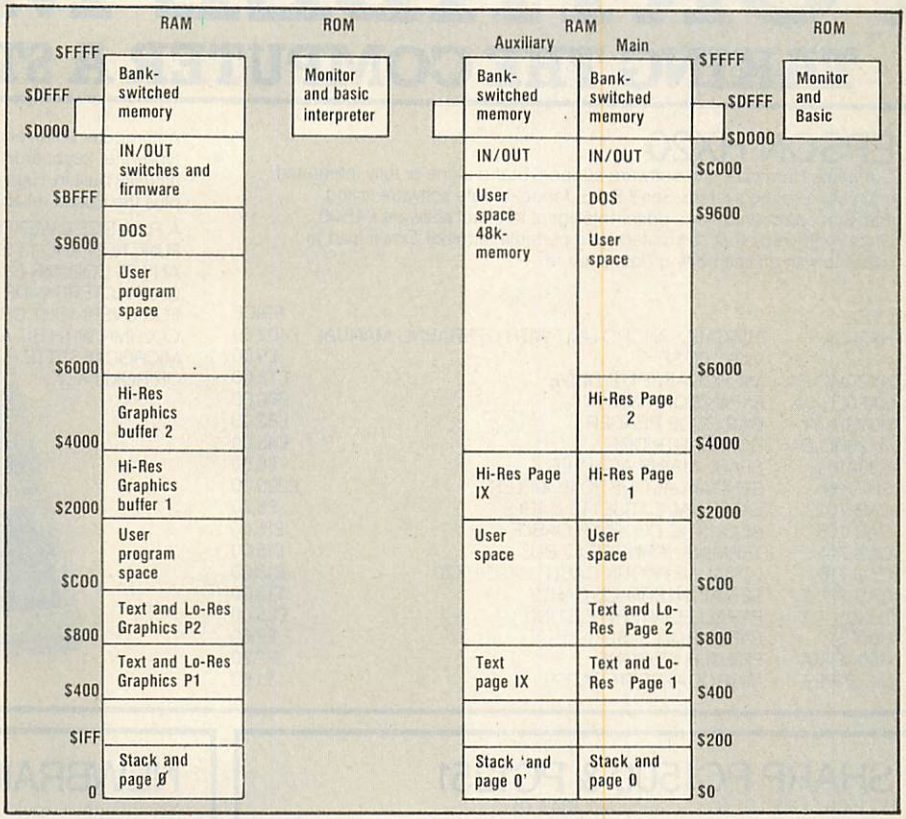

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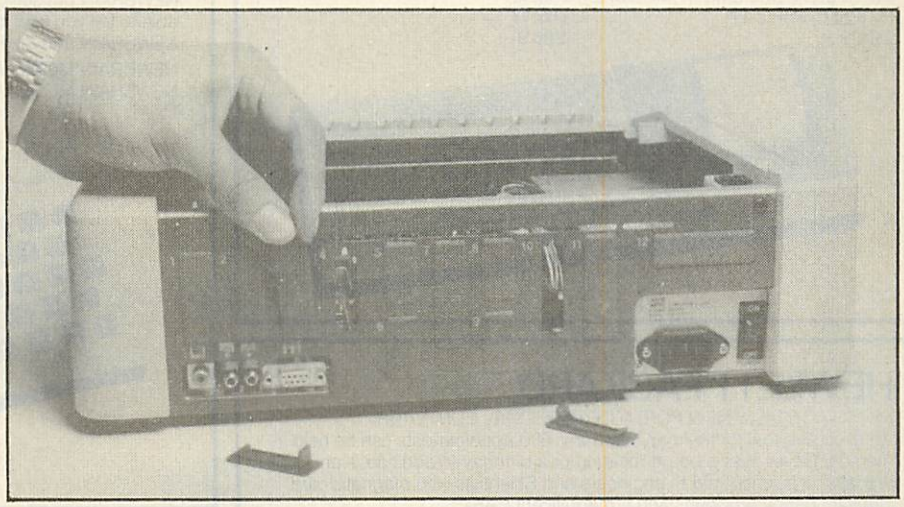

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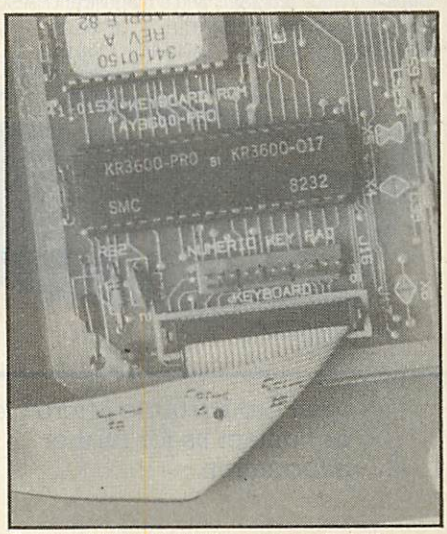

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● Circle No. 162

possibilities for modular programming, but will have to be approached with great caution to ensure that the correct program segments are associated with the correct page 0 and stack. Routines have been provided in the new monitor to move blocks between main and auxiliary memory, and to transfer program control at the appropriate time.

It has only been possible to perform superficial tests on software and peripheral devices. Pascal and CP/M run on the IIe as do a number of major machine-code packages such as VisiCalc. Applewriter II has been re written to accommodate the new 80-column cards, but the existing version works satisfactorily in 40-column mode, or with 80-column cards produced by other vendors when used in conjunction with a pre-boot disc.

VisiCalc takes advantage of the extra on-board memory to permit the construction of larger models. It also works equally well with a variety of other RAM cards, including 128K cards which take their refresh from the motherboard by plugging a ribbon cable into a socket previously occupied by a RAM chip. Apple has also introduced a special version of the multiplan spreadsheet for the IIe.

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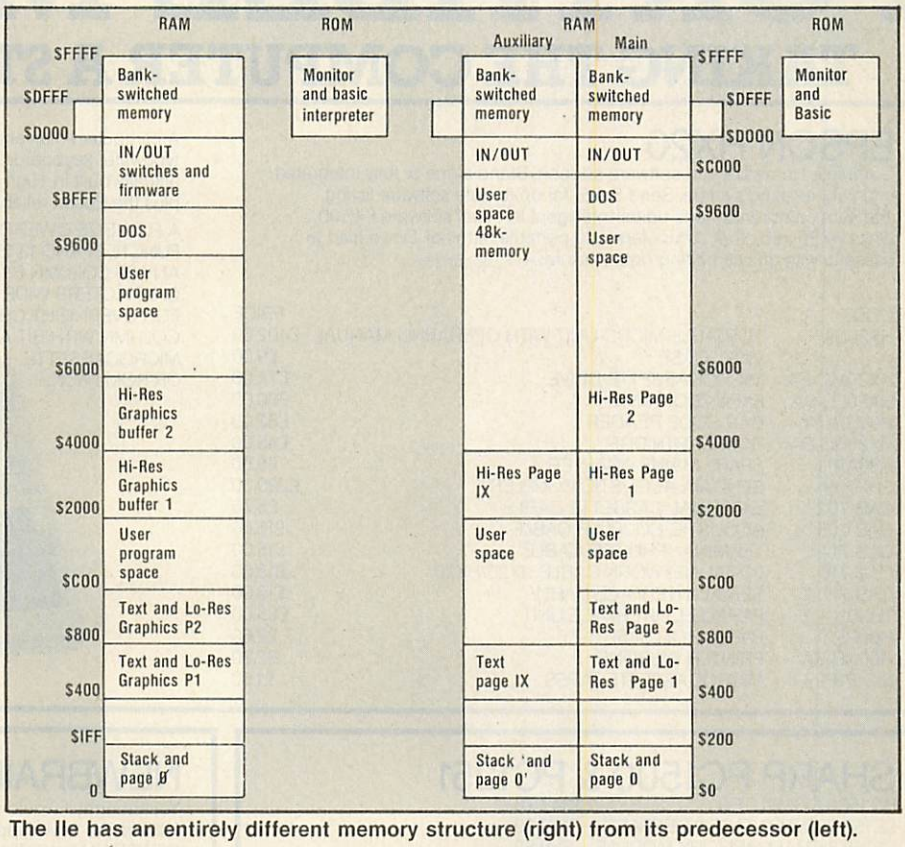

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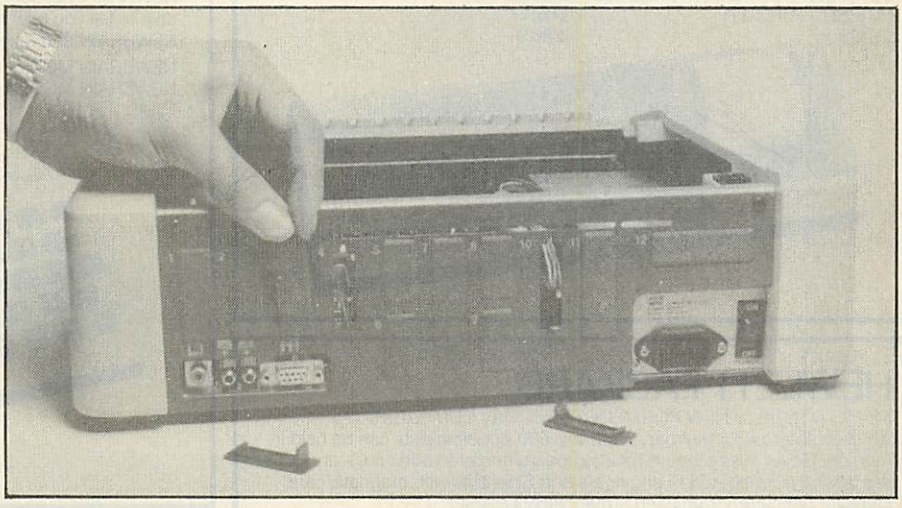

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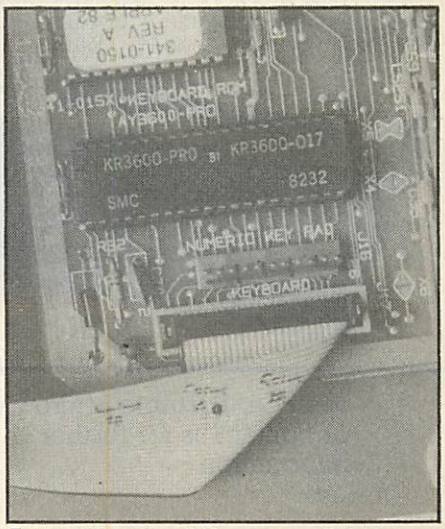

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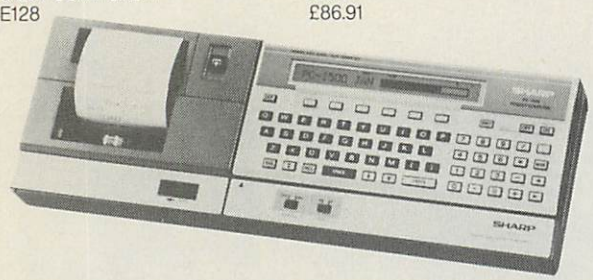

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VIEW

How good a word processor can you squeeze into a 16K ROM? John Harris has been looking at Acorn's plug-in system for the BBC Micro.

RECEIVING Acornsoft's word processor View will doubtless have much the same effect on you as winning the pools. Having waited in vain for so long it comes as quite a shock to realise that it has finally turned up.

For your £59.80 you are supplied with a 16K ROM, a teaching manual called *Into View*, the View Guide reference manual which follows the now obligatory A5 spiral-bound format, and a function-key label card to fit under the transparent plastic strip.

Installing View allows an option: you can decide either to have your machine cold start straight into View, or into Basic as normal. There are five parallel ROM sockets on the BBC processor board, with the operating system sitting in the left-most, the disc-filing system — if you have one — in the next, Basic, View and spare. Whichever chip is in the right-most occupied socket is selected on powering-up, after which switching from one to another is done by prefixing the utility name required with an asterisk, as in *Basic or *Word.

View will operate in any mode, giving a maximum document size in memory of 25K in mode 7 down to 10K in mode 3. These two modes are the only ones of significance to word processing on the BBC: mode 7 gives 40 characters by 25 lines for use with a television or, for larger documents, mode 3 gives 80 characters by 25 lines, for use with a monitor and up to, say, five pages of A4 letter, which is a longer letter than most. Mode 0 provides 80 characters by 32 lines, but the extra seven lines visible costs almost half the remaining space.

In any mode the maximum document width is 132 characters, which falls well short of the maximum usable 240 or so on most 13in. printers operating in condensed mode. It will surely be frowned on by those easily peeved or with good reason to want the wider format. On hitting the right or left screen edge with the cursor, and being under the influence of a permissive ruler, the display will jump left or right to allow continued text entry on the current line.

Three command types exist on View. Command mode commands are reached from Text mode by pressing Esc, and give access to Save, Load, all DFS utilities, printing, word counting and Search and Replace options. Immediate commands are given in Text mode, which is in turn reached from Command mode by pressing Esc.

```
=>*HELP STORED

VIEW A1.4
  CE text              RJ text
  DM xx                EM
  PE (lines)           EP
  OP                   BM lines
  FM lines             HM lines
  TM lines             PL lines
  LM margin            LS lines-1
  FO 0/1               HE 0/1
  HT type code         TS 0/1 margin
  SR r value
  DF /left/centre/right/
  DH /left/centre/right/

OS 1.00
```

CE text — Centre line against ruler
CM xx — Define macro labelled xx
PE (lines) — Page eject, if lines not left
OP — Odd page ejection
FM lines — Footer margin
TM lines — Top margin
LM margin — Left margin
FO 0/1 — Footers off/on switch
HT type code — Redefine highlight function
SR r value — Set register number; for example, SR P=P+10 will skip 10 on page numbering
DF/left/centre/right/ — Define footer
DH/left/centre/right/ — Define header
RJ text — Right justify line against ruler
EM — End macro definition
EP — Even page ejection
BM lines — Bottom margin
HM lines — Header margin
PL lines — Set lines per page
LS lines-1 — Line spacing
HE 0/1 — Headers off/on switch
TS 0/1 margin — Two sided document off/on switch and margin

Table 1. View stored commands.

They are accessed through the red function keys, and they generate different functions to their base functions if the Shift or Control keys are depressed at the same time to give 30 possible immediate functions, only one of which is not used. The third command type is the embedded print-formatting instruction, responsible for line and page formatting, header, footer and macro definition.

So, you are sitting looking at the empty screen page. What can be done with it? There is a default ruler with tabs every eight spaces and 74 characters wide, or 35 characters in mode 7. Together with the current ruler it can be copied, amended or reinvented from scratch. Up to 127 user-defined rulers may be added to it throughout the document.

The ruler which is active immediately precedes the cursor position and is duplicated on the top line of the screen. Besides allowing tabbing, the ruler defines the left and right margin for justification and formatting, which controls wrap-around at the end of each line. Both formatting and justification can be toggled on/off, and are indicated at the top left of the screen.

Six markers are known to the system. The first two are shown on the screen as inverse video, the remainder being invisible. They may be set individually, and the visible ones may be cleared together. The makers provide bounds for such activities as Save, Read, Count, Search, Change, Goto, and the Block Copy, Move, Delete and Format. The Read operation copies a file from disc or cassette into memory.

Putting text on the screen is a simple process. Once you have typed a few pages the cursor movement commands become significant. The arrow key moves the cursor to anywhere on the page, though if you press a character with the cursor beyond the bounds of the ruler, the toggle Release Margins determines whether it stays there or starts a new line. Shift Up and Shift Down pages through the document; Shift Left and Shift Right jumps words instead of characters. Commands available for cursor manipulation are Top and Bottom, for movement to top and to bottom of text; End of line and Go to marker; and the commands Search, with wildcard, an unselective Change, and Replace selective.

Character manipulation is available through Swap Case, Delete and Insert character, Delete to end of line, and the unusual Delete up to a given character. Lines may also be Inserted, Deleted, split and concatenated. An Insert mode toggle allows for continuous insertion or overwriting on amendment.

Continuous processing is an option for disc users only, and involves Editing from file 1 to file 2, requesting More as occasion demands and ending on Finish or Quit. It is a serial process and results in the original and

(continued on next page)

```
=>*HELP CMODE

VIEW A1.4
  LOAD file              SAVE file
  READ file (1)          WRITE file (1 2)

  EDIT filein fileout
  More (1)               Finish
  QUIT

  SCREEN file1...n
  Print file1...n        SHEETS file1...n

  MODE                   COUNT (1 2)
  FIELD chr              FORMAT (1 2)
  PRINTER file           MICROSPACE spacing
  NEW                    OLD

  Search target (1 2)
  Change target result (1 2)
  Replace target result (1 2)

OS 1.00
```

(continued from previous page)

updated files being available on disc at the end. The size of files handled is limited only by the capacity of half a disc. It seems there is no provision for the input file to be resident on one drive and the output on another.

Printing is achieved in Command mode by typing Print or Sheets or Screen file list, where file list has one or more entries to a presumed maximum of around 90. Print is for continuous stationery and a full printout, Sheets for single feed or selective printing, and Screen will show you on the screen what would come out on the printer if you used Print.

The file list is a neat way round the limiting memory effect on document size if you do not want the operational inconvenience of continuous processing, as page and line counts, headers and footers continue as though file list were a single file. All printing operations are performed from cassette or disc only and not from the file in memory, the contents of which are unaffected.

The embedded print-formatting instructions allow line manipulation by way of centring and right justification. Page formatting is by page length, line spacing, margin specification at top, bottom, header, footer and left of page, and page ejection on all, odd or even pages. Line spacing varies from single space to one line per page. Single-line headers and footers may be defined, selected and deselected, and two-sided document margins are provided for.

Macros are areas of predefined text which can be duplicated and expanded at any point in the main text body by a macro call. The duplication and expansion takes place during printing. The macro once defined to the print process by being met in the text — though not printed at that point — remains in effect throughout file list, thereby allowing the printing files to be prefixed in file list by the required macro file libraries. Macros can, of course, also be embedded anywhere in the text itself.

Macros can be multi-line, with up to 10 parameters, and are identified by a two-character mnemonic which may not be an existing command code. A macro is called within the text by using the identifier as a command code itself and carrying the parameters on the remainder of the command.

Number registers are available for command arithmetic operations coded A to Z though not text ones; P is automatically maintained as the page counter and L the line counter. All may be amended at any point in the text and will be printed when prefixed by the split vertical ASCII 124.

When it comes to embedding printer control codes within the text body for highlighting, underlining, double width, condensed mode and so on, the quick-reference guide suddenly becomes very coy. What it says is: "The highlight codes give instructions to your printer to print text underlined (1), or in bold type (2) ... For other Highlight effects and use of the HT command, see the Technical Appendix to *Into View* booklet. Note: for Highlight commands to take effect, your computer must first be operating the correct 'driver' for your printer."

The HT command allows Highlight 1 and 2 to represent any printer function recognised by the printer driver. The driver which is needed to use them and the in-built highlight commands, however, is sold separately on cassette for an additional £9.95. It is a wicked con to say that View sells at £59.80; it costs £69.75 if you are going to use it properly, a tenner less if you are not too fussy.

Format block	F0
Top of text in memory	F1
Bottom of text in memory	F2
Delete to end of line	F5
Move to beginning of line	F4
Move to end of line	F5
Insert line	F6
Delete line	F7
Insert character	F8
Delete character	F9
Move block of text	Shift-F0
Swap case of character at cursor	Shift-F1
Release margins	Shift-F2
Delete up to character	Shift-F3
Start/end Highlight 1	Shift-F4
Start/end Highlight 2	Shift-F5
Go to marker	Shift-F6
Set marker	Shift-F7
Edit stored command	Shift-F8
Delete stored command	Shift-F9
Delete block	Control-F0
Next match for search or replace	Control-F1
Toggle format mode	Control-F2
Toggle justify mode	Control-F3
Toggle insert mode	Control-F4
Copy default ruler to current line	Control-F5
Split line at cursor	Control-F6
Concatenate lines	Control-F7
Mark line as ruler	Control-F8
Move left one character	Left Arrow
Move right one character	Right Arrow
Move up one line	Down Arrow
Move to beginning of last word	Shift-Left Arrow
Move to beginning of next word	Shift-Right Arrow
Move screen one page up	Shift Up Arrow
Move screen one page down	Shift-Down Arrow
Copy block	Copy
Copy current ruler to current line	Shift Copy
Toggle text and command modes	Escape
Delete last character typed	Delete
Insert a Tab and move to next stop	Tab

Table 2. View Immediate commands.

Conclusions

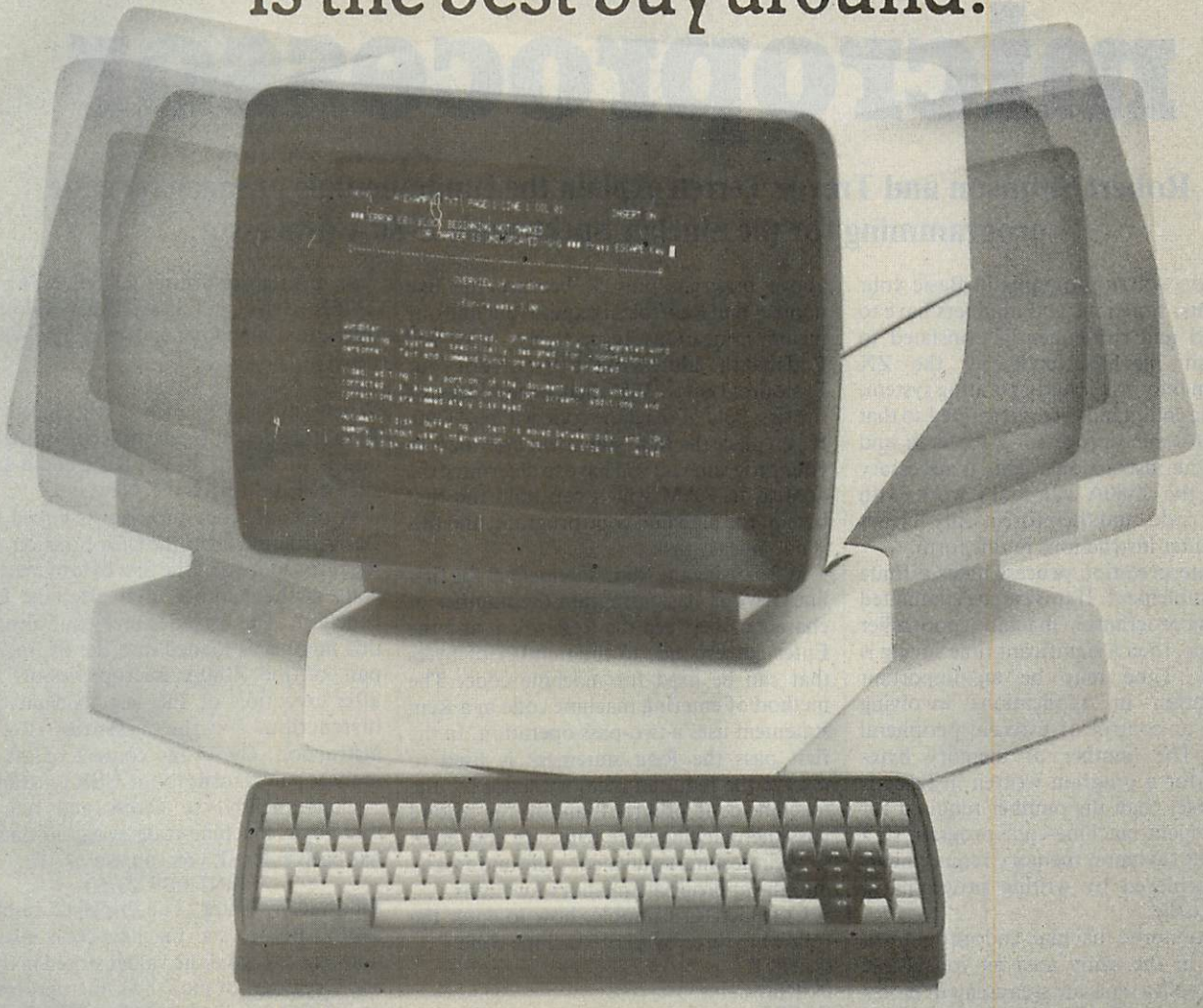
● The View package includes a 16K plug-in ROM, a teaching manual and a reference manual. It costs £59.80, including VAT.

● View operates in conjunction with a BBC Micro with the 1.0 operating system or later.

● To take full advantage of View a printer driver cassette is required, costing an extra £9.95, including VAT.

● View handles well, and is certainly the best word-processing system of its size, but it does lack certain features like the numeric Tab which are available on more expensive word processors.

The Big Screen Micro from KCB at under £1800 is the best buy around!



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● **Circle No. 163**

Programming the Z-80 microprocessor

Robert Simpson and Trevor Terrell explain the fundamentals of machine-code programming for the Sinclair Spectrum's Z-80A processor.

WHEN YOU WRITE programs in Basic your statements, functions and numbers have to be stored and subsequently translated to equivalent machine code by the ZX Spectrum interpreter and operating system. The Basic commands are interpreted so that the Z-80A microprocessor can fetch and execute the instructions. This is necessary because the Z-80A can only work with machine code, and therefore it only fetches and executes instructions in this form.

The interpretation process takes a finite time to implement. If this can be eliminated by writing programs in machine code rather than Basic, then a significant time saving is achieved. Time may be an important consideration in applications involving graphics or control of external peripheral devices. The number of memory bytes required for a program written in Basic is much larger than the number required for the equivalent machine-code program so a significant saving in memory requirements is also achieved by writing programs in machine code.

You can store a machine-code program in memory in the same area as your Basic program or in a separate area created for this purpose between RAMtop and user-defined graphics — see figure 1. To include machine code within a Basic program you may use an appropriate Rem statement.

From a practical point of view, the choice of where to place the Rem statement is governed by the necessity to know the address of the first byte of the machine-code program. When the Rem is the first line of your Basic program, the address of the first byte used for the Basic program is determined by Peeking into the system variable program. This may be achieved using:

```
10 LET x = PEEK 23635
15 LET y = PEEK 23636
20 PRINT "Address of First Byte of
   BASIC"" IS "; x + 256*y
```

The address of the first machine-code byte will be the address obtained using the above program plus 5, because the line number and Rem token require four and one memory locations respectively. You will find that the address of the first byte of your Basic program is 23755, hence the address of the first byte of machine code will be 23760. If you place the Rem statement elsewhere in your program you will have to determine the address in RAM which can hold the first byte of the machine-code program, and this is not an easy task.

When using the Rem statement in the first line of your Basic program the number of characters between the Rem token and the Enter corresponds to the number of bytes that can be used for machine code. The method of entering machine code in a Rem statement uses a two-pass operation. In the first pass the Rem statement is used to reserve the required memory space for the machine-code program, and in the second pass the machine-code bytes are converted to their decimal equivalent code and Poked into the appropriate memory locations.

Consider for example, how to enter the following three bytes of machine code:

```
04 INC B
0D DEC C
C9 RET
```

The first pass operation to reserve the required three memory bytes is achieved by entering:

```
1 Rem bbb
```

where the three characters bbb correspond to the memory bytes for the machine code. The bytes of the machine code must now be converted to their decimal equivalent, that is

04 converts to 04,
0D converts to 13
C9 converts to 201.

The decimal values are subsequently Poked into memory addresses 23760, 23761 and 23762. On completing this two-pass operation your Rem statement line will be listed as

```
1 REM ?
```

When your machine code is included in a Rem statement it is part of a Basic program and is subject to all the Basic commands, such as Edit, List, Save, New, etc.

A machine-code program is linked to a Basic program using the USR function. The memory address of the first byte of machine code is the number used after the USR function. The hexadecimal equivalent of this number is loaded into the BC register pair of the Z-80A microprocessor, and after execution of the last machine-code instruction — the essential Return instruction, C9 — the content of the BC register pair returns to the USR function.

Consequently, to access and run the three-byte machine-code program once it has been entered, you can use

```
PRINT USR 23760
```

followed by Enter. The displayed result is 24015. Before the machine-code instructions are executed the values stored in the B and C registers of the Z-80A microprocessor are 92 and 208 since 23760 = (92 × 256) + 208. After executing the first instruction, INC B, the register contents are 93 and 208, and then after executing the second instruction, DEC C, the register contents are 93 and 207. After the Return instruction, RET, the USR function returns with the value (93 × 256) + 207, or 24015. The USR function is used in a line of Basic program to access the machine-code program, and if you use

```
25 LET x = USR 23760
```

then, after executing the simple machine-code program, the value of x is set equal to 24015.

A Return instruction, RET, must always be included as the last op code in a machine-code program. Otherwise it is quite possible that your ZX Spectrum will fetch and execute the codes which exist in the RAM

The authors are from the Systems and instrumentation division of of Preston Polytechnic. This article is an edited extract from their forthcoming book, *ZX Spectrum User's Handbook*, to be published by Newnes Technical Books.

locations following the end of your machine-code program; since these are unspecified, a crash condition may then result. If that happens, the operating system loses control and the microcomputer becomes incapable of doing anything useful. For example, you will recognise this condition when you are unable to input control commands from the keyboard. The only way to deal with a crash condition is to momentarily disconnect the 9V power supply.

It is possible to store a machine-code program in an area which you create above RAMtop but below the user-defined graphics area. This is the area to be used when you do not wish to have your machine-code program erased by New. In the Spectrum the user-defined graphics area occupies the top 168 bytes of RAM, and RAMtop is normally the next address below this — see figure 1. In the 16K Spectrum RAMtop is normally at address 32599, whereas in the 48K Spectrum it is at 65367.

You can redefine the address of RAMtop by putting the desired RAMtop value in a Clear statement using the form

CLEAR Desired RAMtop value

The Clear command also clears all the program variables, the display file CLS, and Gosub stack, the latter being put at the new RAMtop; it also does a Restore, and resets the Plot position.

When you have redefined RAMtop to reserve sufficient memory bytes for your machine-code program above RAMtop and

(continued on next page)

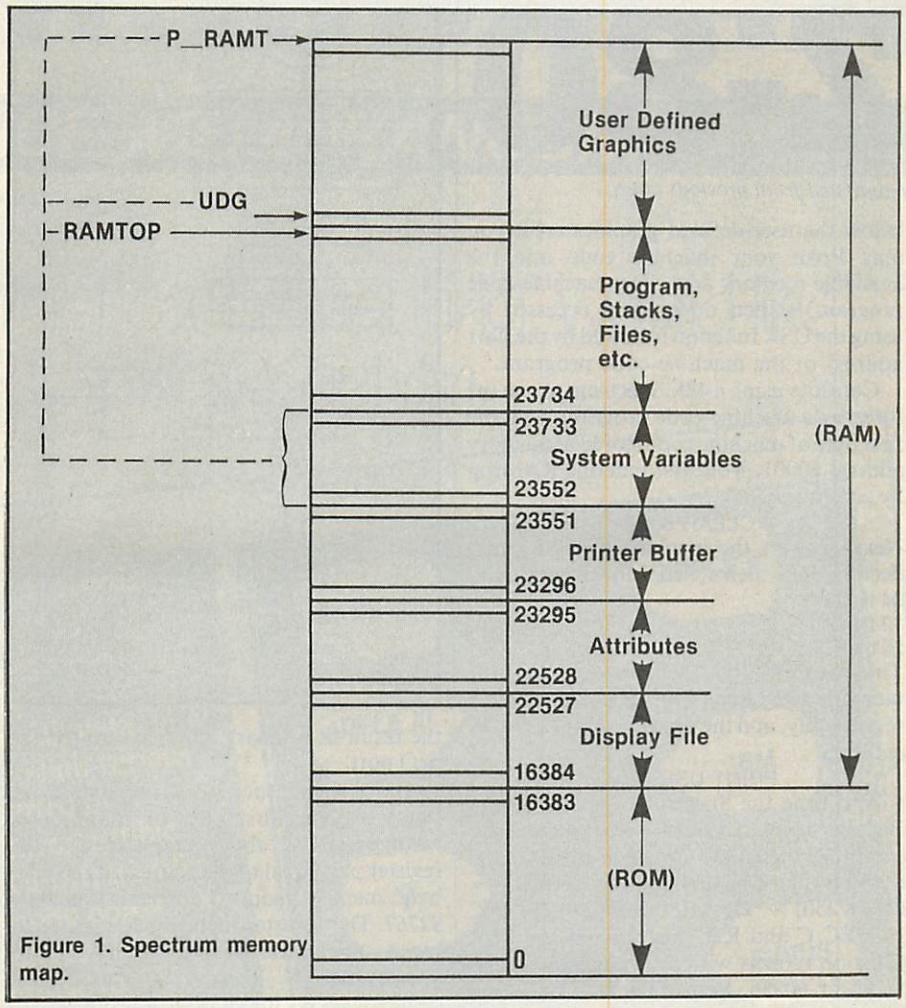

Figure 1. Spectrum memory map.

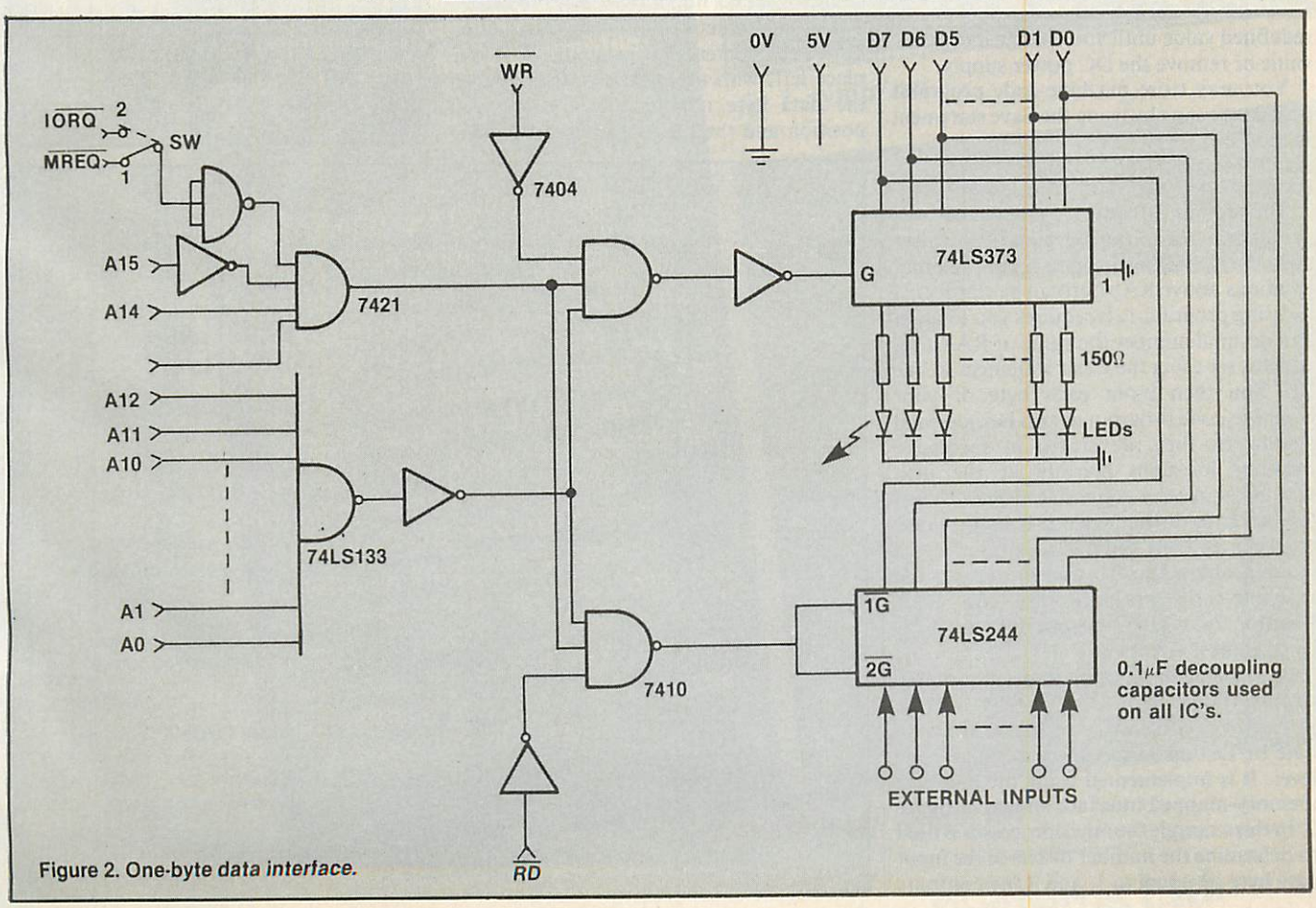

Figure 2. One-byte data interface.

APPLE IBM PC SIRIUS CP/M

● Circle No. 164

BRITISH TECHNOLOGY AT ITS BEST

Big fish caught in small pond

When William Green was sold a faulty micro he demanded his money back. The supplier refused, so he went to court.

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I think it is a good rule to keep copies of correspondence about any relatively expensive purchase — memory is not always

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Having decided to recover my money I wrote to the supplier explaining that I was not satisfied with the machine and asking for my money back. At the same time I returned the machine. A mistake — because in so doing I passed all the actual evidence of a faulty machine to the supplier. In the event it made no difference, although it might have done with a less scrupulous supplier.

The supplier's reply was as expected. It claimed that policy prevented refunds except within a short period of purchase. Since it was not known to me when I bought the computer it was not binding on me. I wrote back pointing this out and promising that should my money not be refunded within a fortnight I would sue. I sent the letter by recorded delivery to avoid any doubt that my threat to sue had been received. I sent the letter to the company's registered address, the official address of the company.

Some years earlier I had successfully sued for a small sum of money in the Small Claims Court and so decided to try that court again. The refund I wanted was under £200 and therefore well within the limits for the Small Claims Court. The Small Claims Court is a branch of the County Court, and not to be confused with a Magistrates Court.

In the Small Claims Court legal and other costs and expenses are limited. The person doing the sueing is asking only for a limited sum of money and will not face possibly high legal costs. An opponent has less opportunity to frighten a poorer adversary by the use of ostentatious, expensive legal assistance. For small amounts it is a very useful way of fighting against a relatively rich opponent. In my case my opponent was a rich company, in another court I might well have faced the possibility of very heavy costs were I to lose. In the Small Claims Court solicitors are not necessary. On the previous occasion I had done without a solicitor and I decided to do so again.

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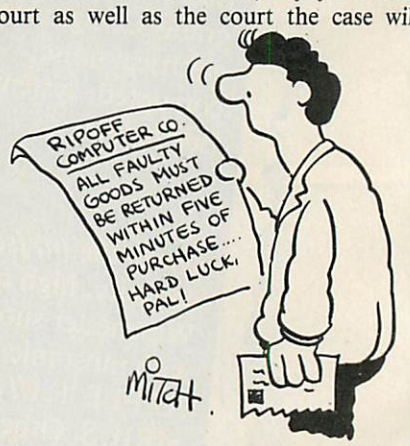

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INTER-OFFICE MEMORANDUM

John
Saw this in Practical Computing Would like demo A.S.A.P please action
M.B.

symb/net. *(n) (see fig 1)* **1.** speedy long range, local area network system, capable of ranges to 9km. utilises fibre optic cable and semi conductor laser to transmit data; **symbnet** enables user to link various microcomputers supported by **symbfile** *(see below)* **2.** compatible with DOS,PASCAL,CP/M; transfer rate 50 kHZ, transmission power 800 micro W cable, fire retardant P.V.C. grade 32, signal insensitive to electrical noise, ∴ cannot be corrupted; system nucleus **symbfile** *(see below).*

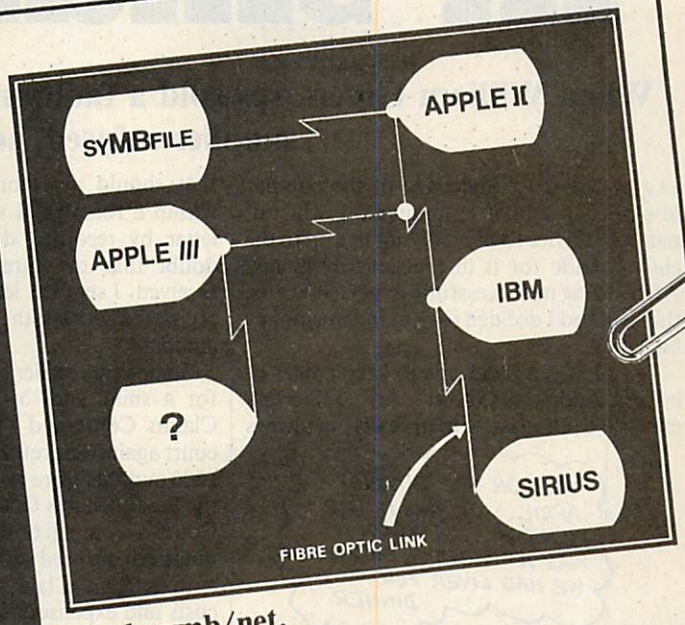

fig 1 **symb/net.**

symb/file *(n) (see fig II)* **1.** high capacity, high quality, $5\frac{1}{4}$" Winchester sub-system, compatible with most microcomputers including APPLE II, III, IBM PC, and SIRIUS. Other features include **2.** a cold booting facility **3.** one year's full warranty. Also available on **symbfile** top quality software including database, word processing and accounting packages. **4.** capacities range from 3-84 megabytes; average speed of access 90ms, 32 sectors per track; rotational speed 3600 (rpm) **5.** used at the centre of network system — **symbnet** (*see above*).

fig II **symb/file**

Symbiotic Computer Systems Ltd.
32 Elmwood Road, Croydon, CR9 2TX. Telephone: 01-683 1137 (PBX) Telex: 893815

APPLE IBM PC SIRIUS CP/M PASCAL DOS

● Circle No. 164

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preparing the particulars of claim do not be tempted to use legal language. Legal people understand English — use it.

I took the particulars of claim, with the Form of Request and appropriate fee to the court. I had to supply in addition a self-addressed envelope in which the court sent me, about a week later, the plaint note, which is both notice that the case has commenced and a receipt for the fee paid. The court issues the summons after receiving the Form of Request, particulars of claim and fee. The case is given a number, the plaint number. All papers to do with the case must be labelled with the plaint number. The plaint number is used in the court office for filing the papers in the case. No plaint number, no papers, no case! The plaint number is given on the plaint note.

My case was one of those for which arbitration was considered appropriate. Aribitration is the alternative to a full court procedure. The smallest claims are automatically subject to arbitration, in other cases the the plaintiff can ask for arbitration. In this case the arbitrator was a Registrar of the County Court. A court Registrar is second

I found it difficult to hear the Registrar.

only to a judge and is one of the more qualified and experienced people in the legal profession. With arbitration there is first a pre-trial review. At the review the plaintiff and defendant appear, and arrangements about the conduct of the trial itself are made. Either party to the case can take up matters which seem important. For example, in my case I tried to get an immediate judgment in my favour.

I failed. What had happened was that the defendant had not put forward a defence until three weeks after the issue of the summons. From reading the notice informing me that the summons had been served, it seemed to me that unless the defence was put up within a fortnight of the summons being issued the plaintiff was entitled to judgment. The Registrar thought differently.

The pre-trial review was something of a shock in other respects. On the previous occasion I had used the Small Claims Court the pre-trial review was held in a small room containing a small table, some quite ordinary chairs and the Registrar, myself and the defendant — a very quiet, informal occasion. That was in another district and at another time.

On this occasion the venue was a real court room. At the front was a dais containing a real judge's chair, complete with the Royal Coat of Arms. Here sat the Registrar. In front of him was the Clerk of the Court behind a bench. In front of his bench was the bench for lawyers, labelled plaintiff at one end and defendant at the other. That was not all. The court was full of people — all the plaintiffs and defendants in that afternoon's cases were there, all talking among themselves.

Those involved in each case had to talk to the Registrar and each other behind the lawyer's bench while the hubbub continued. When my case was finally reached I found that the defendant had sent a solicitor. He had been present in the court almost as long as I had, but did not report his presence to the Clerk until the last minute. It had the effect of delaying my case by a good hour. I found it difficult to hear the Registrar, who spoke very quietly while looking down at the case papers. Most of the time in fact I was not sure what was happening. The defendant's solicitor introduced himself, but while I was trying to say who I was the Clerk was standing between me and the Registrar. I am sure the Registrar never heard me. At one stage I believe the Registrar thought I was a solicitor representing another company.

The solicitor asked for permission to use an expert's report. The Registrar agreed because, he said, computer cases can become technical. The solicitor then asked for disclosure, which is in effect a request to be told of papers possessed by the other side, in this case me, which might be relevant. The request is not always as innocent as it sounds: sometimes papers not disclosed cannot afterwards be used in court, therefore it is wise to include everything you might want to use. Solicitors know this, most other people do not. In this case the relevant papers in my possession were only the letters between me and the defendant, and the advertisement which led to my buying the computer.

The Registrar asked for an estimate of how long the case might take; I had no idea. The solictor shouted: "two hours". The Registrar accepted this, made an Order for Disclosure and one expert's report on each side, and said the trial would be about 10 weeks from then. The whole process took about six minutes. As I left the court the defendant's solicitor advised me to use a standard solicitor's form for the Disclosure. I ignored the advice as I thought that to use a legal form might involve the wrong use of legal terms.

The Order for Disclosure duly arrived. It was a completely unreadable copy of an original — quite useless. I took it to the Chief Clerk's office where I was given a readable copy with an apology. The order required both the defendant and me to supply each other with a list of known relevant documents within 21 days of the date of the order. The poor copy I had been sent nearly caused me to overrun the time given. It had not been sent until nearly two weeks after the pre-trial review, the date of the order. I asked the Court Office if the list had to be sent direct to the defendant and was told I could send the list through the Court Office. This I did so as to avoid any risk that the defendant might not receive the list by the due time.

I never received a list from the defendants and I did not arrange for an expert's report or ask the defendant for a copy of his expert's report. According to the advertisement for the computer you did not need to be an expert to use it.

The date of the trial came and I attended the court. There I found that the trial was due to be held not in the court room where the pre-trial review had been held but in Chambers, in fact the office of the Registrar

Some patience is required.

who was to arbitrate. The Registrar was not the one who had presided at the pre-trial review. Neither the defendant nor his solicitor turned up. The Registrar, after asking me to briefly recount my case, made a judgment in my favour for the full amount I had claimed, plus the fee I had paid for the summons.

The order gave a date by which time the full amount had to be paid by the defendant into court. The court would then pay me. Should the defendant not pay by the due date the plaintiff can issue a warrant of execution. A standard form can be obtained from the Court Office for the purpose. A fee is payable, but advice on how to complete the form can be obtained from the Court Office. The fee is recovered, in addition to your claim, by the bailiff who executes the warrant. In my case, the defendant paid up just one day late. I was about to issue a warrant when the court told me the money I was owed had been paid in.

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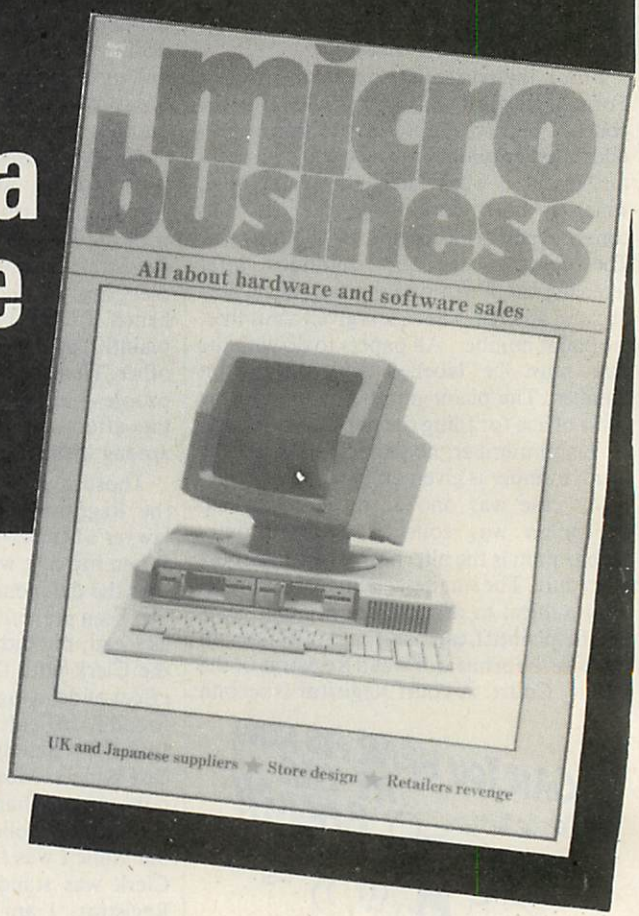

micro business

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51 × 24 DISPLAY

The DRAGON 32 is an incredibly powerful and versatile computer, but for text editing it has some major drawbacks. The small 32 character by 16 line screen format shows you too little of the text and, combined with its lack of lower case letters, bears little resemblance to the way text really looks on the page. Reverse video in place of lower case just adds confusion.

Telewriter eliminates these shortcomings with **no hardware modifications required.** By using software alone, Telewriter creates a new character set that has **real lower case letters,** and puts 24 lines of 51 characters on the screen. That's more on-screen characters than Apple II, Atari or TRS-80 Model III. That's more than double the DRAGON 32's standard display.

FULL SCREEN EDITOR

The Telewriter editor is designed for maximum ease of use. The commands are single key (or single key plus control key), fast, and easy to remember. There is no need to switch between insert modes and delete modes and cursor movement modes. You simply type. What you type is inserted into the text at the cursor, on the screen. What you see on the screen is always the current state of your text. You can move quickly through the text with one key cursor movement in all 4 directions, or press the shift key simultaneously for fast, auto-repeat. You can jump to the top or bottom of the text, and beginning or end of a line, move forward or backward a page at a time, or scroll quickly up or down. When you type past the end of the line, the wordwrap feature moves you cleanly to the next.

You can copy, move or delete any size block of text, search repeatedly for any pattern of characters, then instantly delete it or replace it with another. Telewriter gives you a tab key, tells you how much space you have left in memory, and warns you when the buffer is full.

. . . truly a state of the art word processor . . . outstanding in every respect

The only one with all these features for your DRAGON 32

51 column × 24 line screen display
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Works with any printer
Special MX-80 driver
Requires absolutely no hardware modifications
★ Tandy colour version also available

FORMAT FEATURES

When it comes time to print out the finished manuscript, Telewriter lets you specify: left, right, top, and bottom margins, line spacing and lines per page. These parameters can be set before printing or they can be dynamically modified during printing with simple format codes in text.

Telewriter will automatically number A4 pages (if you want) and centre lines. It can chain print any number of text files from cassette without user intervention. You can tell it to start a new page anywhere in the text or pause at the bottom of the page.

You can print all or any part of the text buffer, abort the printing at any point, and there is a "Typewriter" feature which allows you to type straight to your printer. Because Telewriter lets you output numeric control codes directly (either from the menu or during printing), it works with any printer (Tandy, Seikosha, MX-80, Okidata, NEC 8023, C. Itoh 8510, Centronics, GE Terminet, Smith Corona TP-1, etc.). There's even a special driver for the Epson MX-80 that lets you simply select any of its 12 fonts and do underlining with a single underline character.

CASSETTE INPUT/OUTPUT

Because the Telewriter makes using cassette almost painless, you can still have a powerful word processor without the major additional cost of a disk. The advanced cassette handler will search in the forward direction till it finds the first valid file, so there's no need to keep retyping a load command when you are lost in your tape. The Verify command checks your cassette save to make sure they're good. You can save all or any part of the text buffer to cassette and you can append pre-existing files from those you have in the buffer

ASCII COMPATIBLE

Telewriter turns your DRAGON 32 into the most powerful, lowest cost, word processor in the world today. But that's not all. The simple ASCII conversion program provided with Telewriter means you can use the full power of the Telewriter editor for creating and editing BASIC and assembly language programs. It means you can use Telewriter to prepare or edit text files used with any data communications program.

Telewriter costs £49.95 on cassette and is

AVAILABLE FROM DRAGON 32 DEALERS NATIONWIDE
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MICRODEAL
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24 HOUR ORDERLINE 0726 67676

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* All available drive stepping rates are supported.
* Hard Drive support, can be HANDLED AS A SINGLE DRIVE.
* Hard drive partitioning, one drive can act as up to six.
* Intermix 5", 8" and Hard drives, up to a total of 8 drives.
- Compatible with the Model I Radio Shack Expansion Interface.
- Upward compatible with TRSDOS (2.3 & 1.2 as documented).
- Fully supports Microsoft language products for the TRS-80.
- Complete media compatibility Model I to Model III and back.
- Full support for LOBO's LX-80 interface.
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- A liberal update policy.
- An enhanced BASIC (LBASIC) including:
  - > Upward compatible with Microsoft Basic.
  - > High speed LOAD and SAVE.
  - > Run multiple programs with common variables.
  - > BLOCKED (variable length) files are supported.
  - > DOS commands may be executed from LBASIC.
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- CONVert utility to move files from Model III TRSDOS.
- An Extended Debugging and Monitor program (with disk access).
- CMDFILE for movement of disk and/or tape system (/CMD) files.
- Device independent operation.
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- RS-232 DRIVER for serial support.
- Sophisticated communications software included.
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(continued on next page)

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TCL Software 59/61 Theobalds Road, London WC1X 8SF.
Xitan 23 Cumberland Place, Southampton SO1 2BB. Telephone: (0703) 38740.

Basic comparison

This chart compares 10 versions of Basic, the most popular microcomputer language, as found on a representative cross-section of micros. The Sinclair Spectrum, Dragon 32 and Atari 400 are basically home computers; the Lynx, the Atari 800, the BBC and Commodore 64 sit in the middle ground; and the Newbrain and Epson are portables, both with the powerful Basic normally associated with "serious" micros. The IBM PC is a 16-bit micro aimed more at the business user than the hobbyist and the Tandy model III is a fairly typical eight-bit micro. What is remarkable is not the differences between machines, but what they have in common. Remember that more commands does not necessarily mean a more powerful or easier to use system. A good example is the graphics commands on the Dragon 32 — there are a lot of them, but they are difficult to use.

	Sinclair Spectrum	Dragon 32	Lynx	Grundy Newbrain	Atari Basic	Commodore 64	BBC Basic	Epson HX-20	IBM PC	TRS-80 I and III
Variable name										
long	●				●		●	●	●	
short	●	●	1char	●	●	●		●		●
Numeric types										
integer						●	●	●	●	●
floating point	●	●	●		●	●	9 sig figs	●	●	●
double precision								●	●	●
Declarations										
DEF INT, SNG, DPL, STR								●	●	●
Arrays										
DIM	●	●	●	●	●	●	●	●	●	●
numeric	●	●	●	●	●	●	●	●	●	●
string	●	●		●		●	●	●	●	●
double precision								●		●
multi dimensional	●	●		●	2 max	●	●	●	●	●
OPTION BASE				●				●	●	
Arithmetic										
binary floating point	●			●				●	●	●
16-bit integer								●	●	
BCD floating point					●					
Operators										
arithmetic: *, /, +, −	●	●	●	●	●	●	●	●	●	●
relational: <, >, =	●	●	●	●	●	●	●	●	●	●
AND	●	●	●	●	●	●	●	●	●	
/ DIV: integer division							●		●	
XOR, EOR: exclusive Or							●	●	●	
NOT	●	●	●	●	●	●	●	●	●	
OR	●	●	●	●	●	●	●	●	●	
IMP: implication								●	●	
string concatenation	●	●	●	●	●	●	●	●	●	
string relational	●	●		●			●			●
Functions										
ABS: absolute magnitude	●	●	●	●	●	●	●	●	●	●
ACS, ARCCOS: arc cosine	●		●				●			
ADR: address of string					●					
ADVAL: analogue/digital conversion							●			
ALPHA: location of character			●							

	Sinclair Spectrum	Dragon 32	Lynx	Grundy Newbrain	Atari Basic	Commodore 64	BBC Basic	Epson HX-20	IBM PC	TRS-80 I and III
ANTILOG			•							
ARCSIN, ASN	•		•				•			
ARCTAN, ATN	•	•	•	•	•	•	•	•	•	•
ASC/CODE: ASCII code of first letter	•	•		•	•	•	•	•	•	•
BIN: binary number	•		•							
CDBL: convert to double precision									•	•
CHR$: character string	•	•	•	•	•	•	•	•	•	•
COS: cosine	•	•	•	•	•	•	•	•	•	•
DEG: radians to degrees			•		•		•			
DPEEK: two-byte Peek			•							
EXP: e raised to power	•	•	•	•	•	•	•	•	•	•
FACT: factorial			•							
FIX: transaction		•						•	•	•
FN: user-designed function	•			•		•	•	•	•	
FRE, FREE, MEM: remaining memory		•	•	•	•	•	•	•	•	•
FRAC: fractional port			•							
GETN, GET$, INKEY$: checks keys pressed	•	•	•	•	•		•	•	•	•
HEX$		•						•	•	
INF: simulates infinity			•							
INSTR: string-in-string search		•		•			•	•	•	
INT, CINT: integer part	•	•	•	•	•	•	•	•	•	•
LEFT$, RIGHT$: string slicing		•	•	•		•	•	•	•	•
LEN: length of string	•	•	•	•	•	•	•	•	•	•
LN, LOG: natural logarithm	•	•	•	•	•	•	•	•	•	•
LOG: base-10 logarithm			•				•			
MID$: string slicing		•	•	•		•	•	•	•	•
MOD: modulus							•	•	•	
NOT: returns 1 if x = 0, otherwise returns 0	•				•					
OCT$: octal conversion								•	•	
PEEK: look at memory byte	•	•	•	•	•	•		•	•	•
PI: 3.14159265	•		•	•			•			
POINT: look at pixel	•	•			•		•		•	•
POS: cursor position		•	•	•	•	•	•		•	•
RAD: degrees to radians			•		•		•			
RND, RAND: random numbers	•	•	•	•	•	•	•	•	•	•
SGN: sign determination	•	•	•	•	•	•	•	•	•	•
SIN: sine	•	•	•	•	•	•	•	•	•	•
SQR: square root	•	•	•	•	•	•	•	•	•	•
STR$: character to string	•	•		•	•	•	•	•	•	•
STRING$: copies string		•					•	•	•	•
TAN: tangent	•	•	•	•		•	•	•	•	•
TIME, TIMER: returns current time		•					•	•	•	•
UPC$: converts to upper case			•							
USR: machine-code jump	•	•			•	•	•		•	•
VAL: string to number	•	•	•	•	•	•	•	•	•	•
VAL$: number to string	•									
VAPTR: variable pointer		•							•	•
Control of program flow										
GOTO (line number)	•	•	•	•	•	•	•	•	•	•
GOSUB-RETURN	•	•	•	•	•	•	•	•	•	•
ON..... GOTO, GOSUB		•		•	•	•	•	•	•	•
GOTO (label)			•							
IF-THEN	•	•	•	•	•	•	•	•	•	•
IF-THEN-ELSE		•	•				•	•	•	•
WHILE-WEND			•					•	•	
PROC-ENDPROC			•				•			
FOR-NEXT-STEP	•	•	•	•	•	•	•	•	•	•
REPEAT-UNTIL			•				•			
CALL, EXEC, SYS		•	•			•	•		•	
STOP	•	•	•	•	•	•	•	•	•	
END		•	•	•	•	•	•	•	•	•
CONT, CONTINUE	•	•	•	•	•	•		•		•
PAUSE, WAIT	•		•			•			•	

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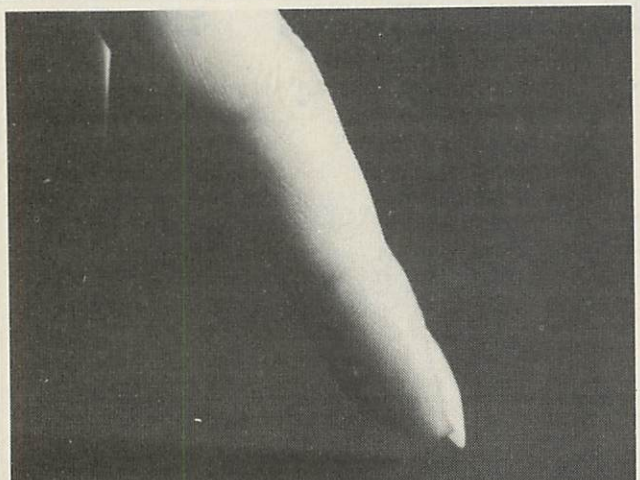
	Sinclair Spectrum	Dragon 32	Lynx	Grundy Newbrain	Atari Basic	Commodore 64	BBC Basic	Epson HX-20	IBM PC	TRS-80 I and III
EDIT: call editor	●	●							●	●
REM: comment line	●	●	●	●	●	●	●	●	●	●
RUN:	●	●	●	●	●	●	●	●	●	●
LIST:	●	●	●	●	●	●	●	●	●	●
NEW:	●	●	●	●	●	●	●	●	●	●
DEL, DELETE		●	●	●			●	●	●	●
RENUM: renumbers program		●	●				●	●	●	
AUTO			●				●	●	●	●
MON: calls monitor			●					●		
CLEAR: deletes variables	●			●			●	●	●	●
SYSTEM: return to DOS									●	●
BYE					●					
OLD							●			
ERASE: clear specific arrays								●	●	
Cassette commands										
BGET#, GET #: get byte						●	●			
BPUT#, PUT #						●	●			
APPEND			●							
LOAD, CLOAD	●	●	●	●	●	●	●	●		●
MLOAD: machine-code load	●	●	●				●	●		
SAVE, CSAVE	●	●	●	●	●	●	●	●		●
TAPE: alter baud rate			●							
VERIFY	●		●	●		●				●
MERGE	●			●				●		●
AUDIO		●								
EOF #		●					●	●		●
MOTOR: turns motor on		●						●	●	
SKIPF: skip to end of program		●								
INPUT#: input data		●				●	●			
PRINT#: write data		●				●	●			
OPEN#						●	●			
CLOSE#		●				●	●			
CHAIN							●		●	
Editing commands										
Abbreviations				●						●
AUTO			●					●	●	●
DEL, DELETE		●	●	●		●		●	●	●
EDIT	●	●							●	●
Multi-statement line	●	●		●	●	●	●	●	●	●
Screen Editor	●			●	●	●		●		
Line editor		●	●	●		●	●	●		●
RENUM, RENUMBER		●	●				●		●	
Listing device commands										
LLIST, LIST	●	●	●		●		●	●	●	●
OPEN: opens channel		●				●			●	
PRINT, LPRINT	●	●	●		●	●	●	●	●	●
LINK			●							
COPY: screen-printer dump	●							●		
LIST O: list option							●			
Disc Commands	Microdrive commands CAT CLOSE# DELETE ERASE FORMAT MOVE OPEN#			CLOSE GET # FILE$ INPUT# LINPUT# LOAD# LIST# MERGE# OPEN PRINT# PUT # SAVE# VERIFY#	CLOSE DOS LOAD NOTE OPEN POINT PRINT PUT SAVE STATUS XIO	CLOSE CMD GET # INPUT# LOAD OPEN PRINT# SAVE VERIFY	BGET# BPUT# CLOSE# EOF # EXT # INPUT# LOAD OPEN IN OPEN OUT PRINT# PTR# SAVE		BLOAD BSAVE CLOSE FILES GET INPUT# LINE INPUT# KILL LOAD MERGE NAME OPEN PRINT# PRINT# USING PUT RESET SAVE WRITE#	CLOSE CMD GET # INPUT# OPEN PRINT# CVD CVI CVS CDBL CINT CSNG MKD$ MKI$ MKS$ EOF KILL LOF FIELD LSET RSET
Input/Output statements										
DATA-READ	●	●	●	●	●	●	●	●	●	●
RESTORE	●	●	●	●	●	●	●	●	●	●
RESTORE (line number)	●		●	●			●		●	
GET				●	●	●	●	●	●	
INPUT	●	●	●	●	●	●	●	●	●	●
LINE INPUT, LINPUT		●		●				●	●	●
KEYN: code of key pressed			●					●		
PRINT	●	●	●	●	●	●	●	●	●	●
PRINT AT, PRINT@	●	●	●							●
PRINT USING		●						●	●	●
TAB	●	●	●	●		●	●	●		●
WIDTH							●	●		

	Sinclair Spectrum	Dragon 32	Lynx	Grundy Newbrain	Atari Basic	Commodore 64	BBC Basic	Epson HX-20	IBM PC	TRS-80 I and III
SPC: Space						●	●	●		●
POS: returns cursor position			●	●	●	●	●	●		
CLS: clear screen	●	●	●				●	●	●	●
BRIGHT	●									
FLASH	●									
INK: ink colour	●		●							
INVERSE	●									
PAPER: background colour	●		●							
OVER	●									
CCHAR: defines cursor character			●							
CFR: set cursor rate			●							
OUT: byte to port	●		●							●
IN, INP: value of port	●		●							●
ROUND ON, ROUND OFF			●							
EVAL							●			
VPOS, CSRLIN			●				●	●		
VDU							●			
SCROLL	●							●		
COUNT: counts printed characters							●			
COLOUR							●		●	
LOCATE: position cursor									●	
WRITE									●	
Other Basic Statements										
LET	●	●	●	●	●	●	●	●	●	●
TROFF: trace off		●	●				●	●	●	
TRON: trace on		●	●				●	●	●	
CODE: stores hex			●							
ERROR: generates error code			●	●			●	●	●	●
EXT: allows for extensions			●							
RANDOM, RANDOMIZE	●		●	●					●	●
RESERVE: moves stack			●	●						
SWAP: swaps two variables			●						●	
ATTR: attribute	●									
SCREEN$	●									
ON ERROR GOTO				●			●	●	●	●
REPORT				●			●			
ERL: error line number				●			●	●	●	
LOCAL: local variable							●			
OPT: option							●			
DATE$								●	●	
DAY								●		
Machine language	PEEK POKE USR	DEFUSR EXEC PEEK POKE USR VARPTR	full machine-code monitor	CALL FREE GET PUT RESERVE TOP PEEK POKE	ADR PEEK POKE USR	PEEK POKE SYS USR	CALL HIMEM LOMEM PAGE TOP USR	CALL DEF SEG DEF USR PEEK POKE USR VARPTR	DEFUSR INP OUT PEEK POKE VARPTR	DEFUSR EXEC PEEK POKE USR VARPTR
Graphics commands	BORDER CIRCLE DRAW INK OVER PAPER PLOT	CIRCLE COLOR DRAW GET LINE PAINT PCLEAR PCLS PCOPY PMODE PRESET PSET PUT RESET SCREEN SET	DRAW INK MOVE PAPER PLOT WINDOW	OPEN COLOR DRAW DRAWBY MOVE MOVEBY TURN TURNBY CENTRE RANGE DOT ARC AXES FILL BACK-GROUND WIPE MODE	COLOR DRAWTO GRAPHICS SET COLOR LOCATE PLOT	Peek and poke only PLOT VDU	CLG COLOUR DRAW GCOL MODE MOVE PRESET POINT PUT SCREEN	CIRCLE COLOR DRAW GET LINE PAINT PSET	SET RESET Peek and pokes	GRAPHICS COLOR SCREEN LINE PSET PRESET
Sound commands	BEEP	PLAY SOUND	BEEP SOUND	need additional hardware	SOUND	Peek and Poke only	ADVAL ENVELOPE SOUND	BEEP SOUND	additional hardware	SOUND
Sensing world	IN OUT	JOYSTK	INP OUT	GET and PUT	PADDLE PTRIG STRICK STRIG	Peek and Poke	ADVAL	COM ON COM ON PEN GOSUB ON STRIG GOSUB PEN STRIG OUT INP STICK	IN OUT	Peek and Poke requires extra hard- ware



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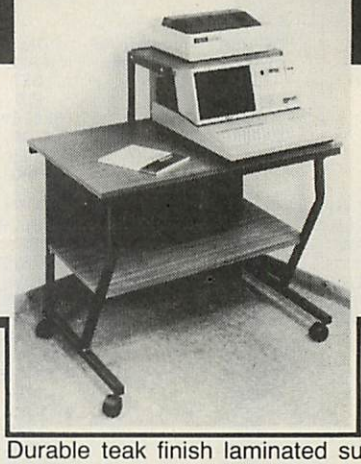

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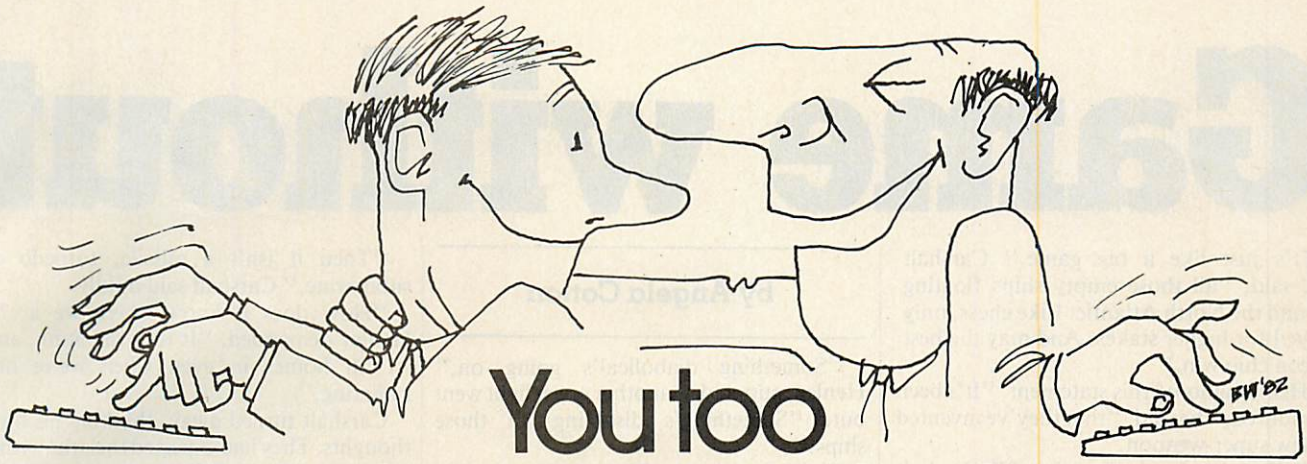

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Game without

by Angela Cotton

"It's just like a big game," Carshalt said, "all those empty ships floating around the North Atlantic. Like chess, only played for higher stakes. And may the best silicon chip win."

Henley ignored this statement. "It's been rumoured," he said, "that they've invented a new super-weapon."

"Oh, what kind of weapon?" Carshalt asked cheerfully. The game needed livening up.

"The rumour doesn't say. We don't know anything about it, except that it seems to work."

"Overcomes jamming, I expect," Carshalt opined flippantly. Henley looked sad.

"No, it's better than that. Not electromagnetic at all: can't be stopped. We can't even detect the damn thing."

"Probably uses a different wavelength," Carshalt said. "There are a few bands considered so useless that we never bothered with them."

Henley shook his head. "Not EM at all," he repeated.

Well, why not? Carshalt thought. They had exhausted that line of research. Nevertheless, the news disturbed him a little. Secure in their laboratories with their computers and their simulated weapons, the scientists were out of touch with the realities of the game. Carshalt could barely conceive of this war as being real, could not picture the real ships which the computers moved about the sea.

To widen his horizons, he had read about the wars of the past, incredulously picturing soldiers running at one another with swords or bayonets. He read with disbelief the learned theses designed to prove that nuclear war would be final. But most homes had a fallout shelter now, and men no longer served in modern war machines. Strategic nuclear weapons had never been used anyway.

War held no horrors for Carshalt; it was all unreal, no less than the electronic drama of the present. They were civilised now. They played their games with computers.

Henley had left the room. Carshalt followed him to join Commander Finns RN, in the adjacent terminal room. Here one could watch the light move about on the large screen, following the computer-controlled movements of the fleet. Picturesquely, the enemy ships were indicated by red. There were few of them; nothing like the number which the simulations and previous wars had led the computer to expect. Their own ships were denoted by green and were steadily decreasing in number.

"Something diabolical's going on," Henley muttered as another green light went out. "Something's disabling all those ships."

The spot where the ship had been was now showing yellow, indicating that an aircraft or another ship had picked up on its radar the inert hulk of metal.

"They're not hitting us with their missiles. Our computers just stop working," Finns accused Henley, who had helped to equip those ships and to program their computers.

Finns had been watching it all day as ship after ship found its computer system failing to operate.

"It's clever, I agree," said Carshalt. "First they disable them, then the big ships or the aircraft move in with their missiles." He noticed that one of the red lights had moved and was now closer to the yellow. In a while, a missile would be fired at the undefended ship, the yellow light would be gone and another ship sunk.

It would not take long: the ships were quite close together. Their separation was determined by that compromise which made a strike most difficult for the enemy at minimum cost to their own missile accuracy. Under normal circumstances it would mean deadlock, for the automatic attack and defence systems were evenly matched. It had always meant deadlock, until now.

"There's nothing we can do, they're just wiping us out one by one," Henley moaned. He reminded Carshalt of a chess player who was watching his opponent systematically removing his pieces from the board without regard to the rules of the game.

"I expect Command computer will recommend surrender at any moment now before we lose all our ships," Henley added. "Not to mention billions of pounds worth of equipment."

The stakes are higher than that, Carshalt thought. Aloud he asked, "What do the aircraft instruments show us of this 'super weapon'?"

"Nothing. Absolutely nothing except sea-clutter. There's just nothing there, either under the sea or above it."

"Then it's something your instruments can't detect," Commander Finns observed shortly. Henley reacted in anger to this criticism of his scientific work. "There's nothing there. We can detect a missile as short as this —" he spread his arms "— and there are none around. Not a single missile, torpedo or submarine."

"Then it isn't a missile, torpedo or submarine," Carshalt said mildly.

"How does it know where we are?" Henley demanded. "It isn't radiating, and it still homes in even when we're not radiating."

Carshalt turned away, thinking his own thoughts. They had expected this war — this game — to be like all the others, with the only losses those caused by faulty equipment, ending in stalemate. It had happened every time ...

A shout from Finns brought him back to reality. "Look at this, Henley."

"What? Oh, my God! I never thought it would ..."

Carshalt turned too, his eyes enquiring of Henley what had happened.

"Command computer recommended surrender, and the recommendation went through ... but they won't let us. They won't let us!" He was almost screaming it. Carshalt walked over to the printed message on Finns' terminal.

In the two relevant languages, it said: "Our Command computer regrets that surrender cannot be accepted at this stage. It is too late to alter our plans until 0900 GMT. We will, however, cease from sinking those ships which have been disabled."

"Nine o'clock!" Henley exploded. "Information travels at the speed of light, and they can't tell their ships to stop till tomorrow morning!"

"They aren't using EM radiation," Carshalt reminded him quietly.

"Dammit man, what are they using?" Henley rounded on him.

"I have an idea ... but it's too fantastic." He turned to Finns, "Can you get me some of the video tapes from aircraft fly-bys?"

Finns nodded and typed something on the keyboard in front of him. Unnoticed behind him, another green light winked out and became yellow. The yellow light did not go out.

"Why did we ever let it start?" Henley moaned. He was beginning to realise what it meant.

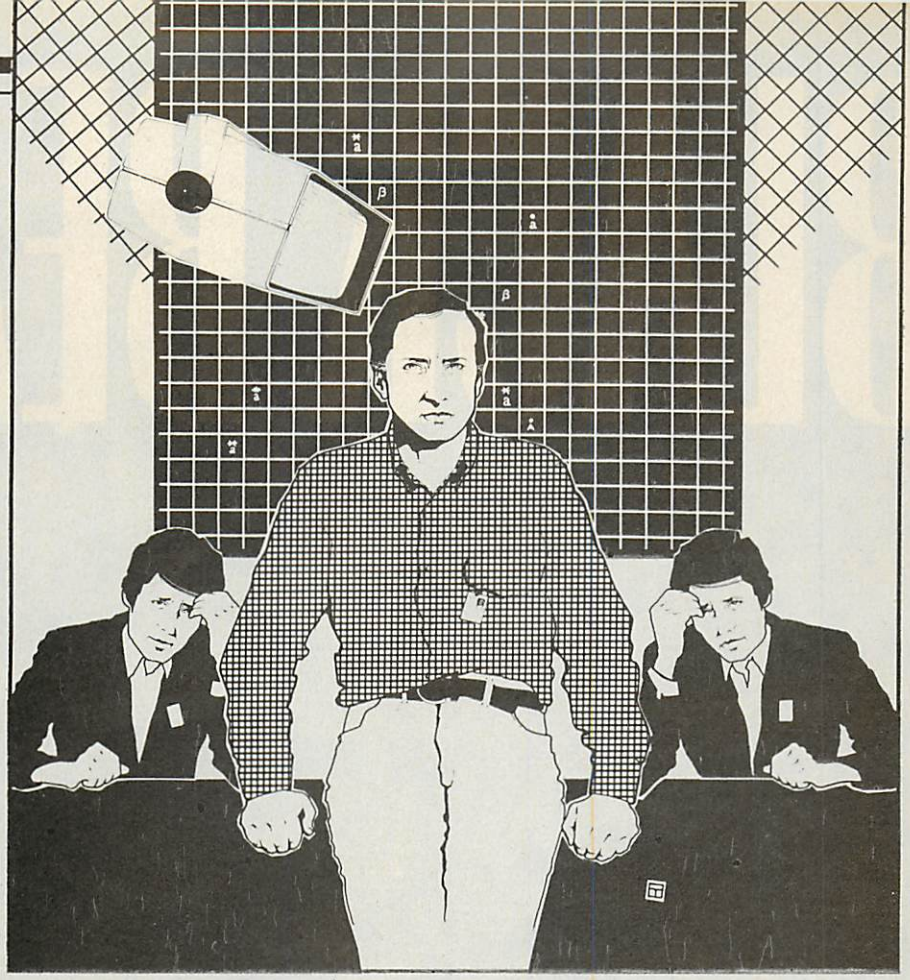
"We didn't start it," Finns said stiffly. "It was their inexcusable actions."

We didn't have to declare war just because of them occupying a petty little state like that ... "

We declared war, Carshalt mused, because it was the thing to do. Because we thought it would make our position clear; then the war would end in stalemate and we'd compromise and they'd water down their demands and nobody would lose face.

He stared at the TV monitor on which the video tapes were being displayed, pondering

rules



how sour the game had turned. Behind him, Finns and Henley were discussing the non-use of the nuclear option. It was one of the rules of the game that if you had pledged not to be the first to use strategic nuclear weapons, then you did not do so. Command computer had no doubt been programmed with that rule.

Ignoring the conversation, Carshalt watched the video. Daylight TV, low-light TV, thermal imager: he could take his choice, but it would do him no good. The quality of the tape was poor. It had been computer enhanced, and it was still poor. Better, but still poor. Useless for his purpose.

"Damn computer," Carshalt said. "It was programmed with what to expect, so that when the unexpected came it processed it right out of the picture."

"We thought we knew what to expect," Henley said. His team had produced the software for the video processing. "We knew all their electronic capabilities, just as they do ours. In the simulations —"

"Forget your simulations," Finns said. He turned to Carshalt: "What did you expect to see?"

"Until today, the same as Henley." Carshalt headed a research team, too. He was not blameless in the catastrophe that had befallen them. "Now I'm not sure. Something, maybe, so small that it's indistinguishable from the sea background, moving almost at random, so slowly that Doppler radar won't notice it, something using so little heat that it's effectively the same temperature as the sea."

"No such thing exists," Henley said. "You need power, a homing device, speed and manoeuvrability."

"It exists," Carshalt stated, "and it's knocking out our ships. Look."

They looked. The fleet had been decimated. Yellow lights, disabled ships, were dotted about the screen. As promised, they had not actually been sunk. Without the ships to protect them, the aircraft were being shot down. Command had ceased its reconnaissance flights, knowing they were useless against the invisible enemy.

A new message appeared on Finn's screen.

"The PM's personally offered to surrender," Henley read, "but their Command computer says it isn't possible yet. But we're still choosing not to go nuclear. Damn them, this'll cost a fortune to rebuild."

Carshalt changed the subject. He had lost interest in the game, but he wanted to understand the secret weapon: "Are there any unenhanced tapes available?"

"Of course not," Henley snapped. His thoughts still ran on the tramlines of the game. Too bad.

"Then tell Command to get one. I want an aircraft to fly as low as possible over any ship beginning to show computer malfunctions. Use every wavelength we can get, and I want the raw tapes. I don't care if we lose the plane."

"It's beyond my authority to order that," Finns said, but he typed his request on the console, and they waited.

Tapes came for Carshalt, and he viewed them while they waited. A message arrived, formally accepting surrender from 0900 and promising that an occupying force and machines would be sent in anticipation of that time.

Messages came from their allies, regretting the situation but reaffirming that no aid could be sent. The country had started the war alone, and alone she must face the consequences.

As nine o'clock approached, Carshalt found what he was looking for. He knew now why the computer couldn't find the secret weapon. Programmed with the rules of the game, it failed to recognise the pattern of the weapon and subtracted it with the noise from any sensor on which it registered. The computer was blind to it.

The scene showed on daylight TV. Carshalt replayed it, adjusting the contrast and brightness, marvelling at the daring of it. They almost deserve to win, he thought, if they can make a scheme like this work.

He called Henley and Finns over, and replayed the tape. It was a beautiful shot, catching the secret weapon in the act of destruction. In spite of himself, Carshalt smiled. They might have lost the game, but at least they knew the weapons that had beaten them.

Then he smiled again at the expressions on the other two faces as they realised what he was showing them. Henley was incredulous; Finns' stern face cracked into an expression of horror, then almost amusement. "Why, it's barbaric — how could they dare?"

"Wars always used to be barbaric," Carshalt reminded him. "Why should it be different now, just because we do it in a civilised way with electronics and computers?"

Carshalt froze the replay and let them look at the scene more closely.

The man stood on the edge of the ship, barely holding the rifle with which he had systematically sabotaged the entire computer network. Below him, barely in view, was the vessel in which he had rowed, or perhaps earlier sailed, to reach the ship. His companion waited for him.

Carshalt released the Freeze button and let the tape play on to its end, watching without sorrow as the small boat suddenly keeled over, and the man with the rifle swayed and lost his balance and slipped into the sea. Seconds later the scene exploded as the undefended aircraft, which had recorded the scene guided only on this kamikaze course, was hit by a missile.

Alone now, the dead ship floated uselessly, at the cost only of two expendable enemy lives.

"Just a simple game," Carshalt muttered, "a game without rules." But only one side had been playing the game. It was nine o'clock and they had lost for real.

Beyond him, out in the street, screams were heard as the first enemy tanks rolled into London.

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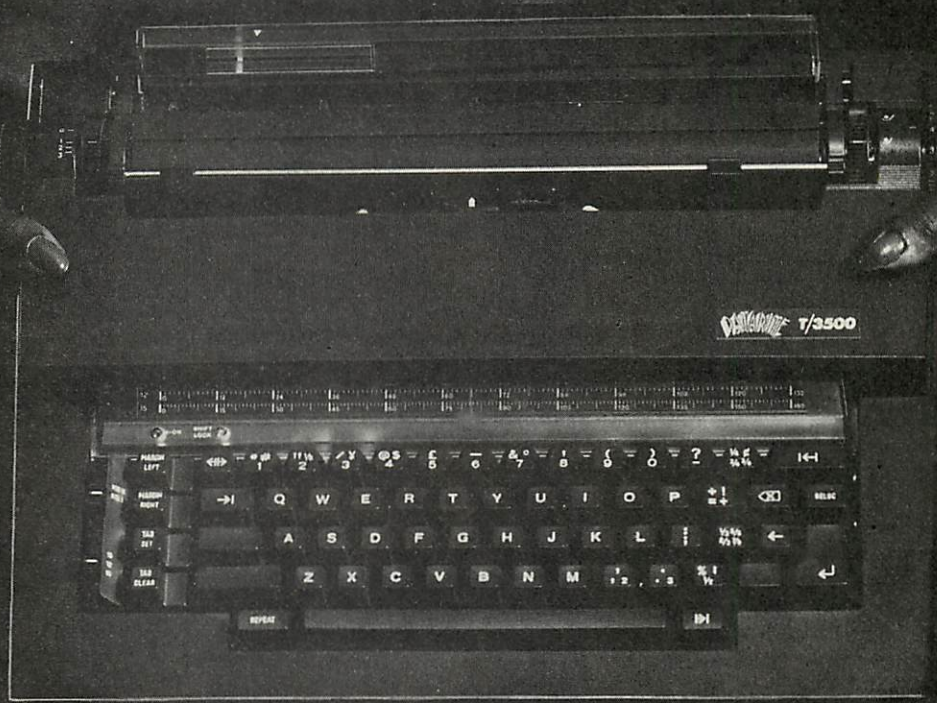

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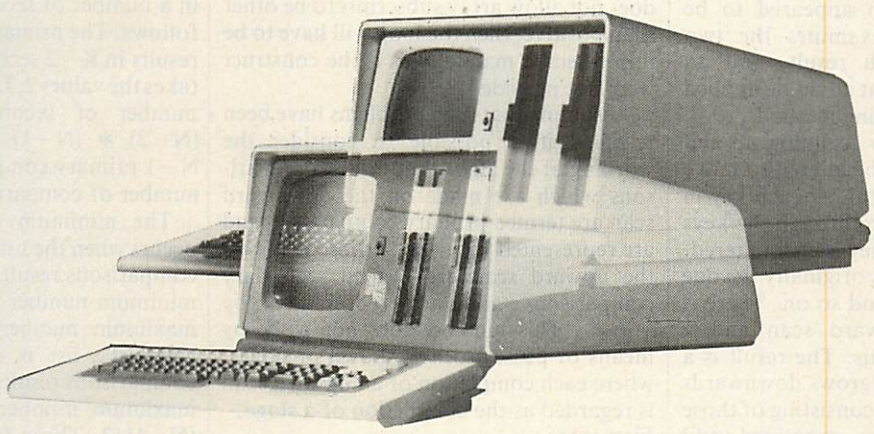

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Know your sort

Andrew Featherstone completes his survey of simple sorting methods with the shuttle, delayed-exchange and shell sorts.

THE FIRST ARTICLE in this series — March issue, page 120 — examined four linear sorting methods. Starting from the simplest way to sort a list of items it worked through a sequence of refinements of the initial method, leading to a point at which a new approach appeared to be needed. This article examines the two further methods which result, and an additional technique that could be applied to any of the six preceding methods.

Instead of repeatedly scanning up and down, the method can be altered to move down through the list, taking each key in turn and lifting it up up through the keys above it until a lighter key is encountered. Then the key which was originally the one below it is examined, and so on. There is then only one downward scan and a number of upward scans. The result is a sorted sequence, which grows downwards from the top of the list, consisting of those keys which have been examined and moved up as far as necessary. This is called the shuttle sort.

The algorithm for this method is shown in figure 1. The variables are as before except for the disappearance of PB, PP, PF, PT and the appearance of two new variables:

FP — forward pointer, marking the element reached on the downward scan.

BP — backward pointer, marking the element reached on the upward scans.

It is quite possible that statement 5

Repeat - Until BP ≦ 0 ∨ K$ (BP + 1) ≧ K$(BP)

could cause problems. If the language used does not supply the Repeat-Until construct the facility has to be provided manually. At the end of the statements in the loop would have to be written

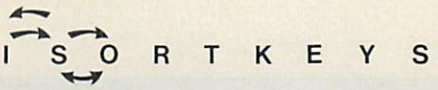
If BP > 0 ∧ K$ (BP + 1) < K$ (BP) Then go to beginning of loop.

Different systems will treat this statement in different ways. Economical systems will use the result of the first simple condition to decide whether or not the second simple condition needs to be evaluated in order to determine the outcome of the compound condition, and so will not bother to evaluate the rest if BP = 0. Pedantic systems will want to evaluate both simple conditions before establishing the truth of the compound condition by using the logical operator. Such systems will come unstuck if BP = 0 in attempting to access K$(0).

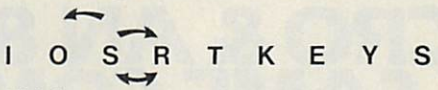
If the manual Repeat-Until is being used, the way round this is to replace the And with a Then If. Otherwise, the way out is to use the sentinal technique. Declare K$ such that it includes an element K$(0), to which K$(FP) is moved before the inner Repeat-Until commences, and drop BP ≦ 0 and the Or from the termination condition. If the language you are using does supply the Repeat-Until construct but does not allow array subscripts to be other than positive, then the loop will have to be implemented manually as if the construct were not provided.

Assuming that such problems have been resolved it is possible to consider the working of the algorithm. Those comparisons which are made on the downward scan are termed primary comparisons and are represented by ⟶ ; those made on the upward scan are termed secondary comparisons and are represented by ⟵ . This method does not work by means of passes so it is shown in stages, where each completion of an upward scan is regarded as the completion of a stage.

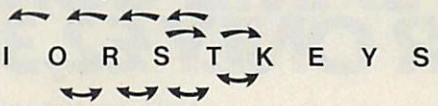
First stage



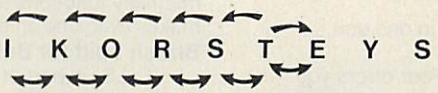
Second stage



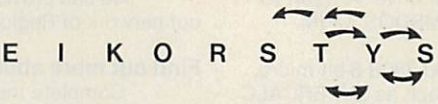
Third stage



Fourth stage



Fifth stage



At the end of the fifth stage the keys are in the following order:

E I K O R S S T Y

The downward scan has reached the end of the list and so the sort is complete; in terms of the algorithm FP > NK. The total number of comparisons is

3 + 2 + 6 + 6 + 4 = 21

and the total number of exchanges is

1 + 1 + 4 + 6 + 2 = 14

The new method has in this case reduced the number of comparisons by four, though the usual analysis again does not show this increased efficiency.

The minimum number of comparisons occurs when the list is ordered. In that case no secondary comparisons result from any of the N − 1 primary comparisons, so the minimum number of comparisons is N − 1.

The maximum number of comparisons occurs when the list is reversed, when each of the N − 1 primary comparisons results in a number of secondary comparisons as follows. The primary comparison at key K results in K − 2 secondary comparisons; K takes the values 2,3, . . . N so that the total number of secondary comparisons is (N − 2) * (N − 1)/2. Together with the N − 1 primary comparisons the maximum number of comparisons is N * (N − 1)/2.

The minimum number of exchanges occurs when the list is ordered: none of the comparisons results in an exchange so the minimum number of exchanges is 0. The maximum number of exchanges occurs when the list is reversed: each of the comparisons results in an exchange, so the maximum number of exchanges is N* (N − 1)/2. These figures are the same as before, so the new method does not appear to have made any improvement. However, in the general case the new method does lead to a satisfactory reduction in the number of comparisons.

There is still room for improvement, though to the number of exchanges rather than the number of comparisons. Suppose there is a key which has to be moved several places up the list. It is done by comparing the key with its predecessor, exchanging them, comparing it with its new predecessor, exchanging them, and so on.

The trouble is that an exchange has to be made by extracting the offending key from the list, moving the preceding key down one place, and inserting the extracted key into the space vacated by its erstwhile predecessor. The key which is moving up will repeatedly be replaced and removed before it reaches the right position, but it would be better not to replace the key until the right position has been found.

Figure 2 describes this new procedure. As before, statement 6

Repeat - Until BP ≦ 0 ∨ T$ ≧ K$(BP)

could cause problems. It might appear that it will be a trifle difficult to count the exchanges made by a method which does not actually seem to make exchanges as such. It can be done, though. An exchange entails removing a key, moving down its predecessor and replacing the key — three distinct data transfers or moves. These three moves are all present in the improved method so the exchanges can be counted by counting each of these moves as one-third of an exchange.

Figure 1.

```
(1) FP: = 2
(2) repeat (3) BP: = FP – 1
          (4) if K$(FP) < K$(BP)
              then (5) repeat (6) T$: = K$(BP + 1)
                              (7) K$(BP + 1): = K$(BP)
                              (8) K$(BP): = T$
                              (9) BP: = BP – 1
                   until BP ≦ 0 ˅ K$(BP + 1) ≧ K$(BP)
          (10) FP: = FP + 1
   until FP > NK
```

Figure 2.

```
(1) FP: = 2
(2) repeat (3) BP: = FP – 1
          (4) if K$(FP) < K$(BP)
              then (5) T$: = K$(FP)
                   (6) repeat (7) K$(BP + 1): = K$(BP)
                              (8) BP: = BP – 1
                        until BP ≦ 0 ˅ T$ ≧ K$(BP)
                   (9) K$(BP + 1): = T$
          (10) FP: = FP + 1
   until FP > NK
```

Figure 3.

```
(1) I: = 2**INT(LN(NK – 1)/LN(2))
(2) repeat (3) CALL SORT (NK,K$(NK),I)
          (4) I: = I/2
   until I < 1
```

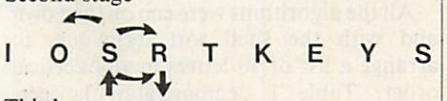
```
1500 REM SHUTTLE SORT
1501 LET FP=2
1502 LET BP=FP-1
1503 IF K$(FP)>=K$(BP) THEN GOTO
 1509
1504 LET T$=K$(BP+1)
1505 LET K$(BP+1)=K$(BP)
1506 LET K$(BP)=T$
1507 LET BP=BP-1
1508 IF BP>0 THEN IF K$(BP+1)<K$
(BP) THEN GOTO 1504
1509 LET FP=FP+1
1510 IF FP<=NK THEN GOTO 1502
1511 RETURN

1600 REM DELAYED EXCHANGE SORT
1601 LET FP=2
1602 LET BP=FP-1
1603 IF K$(FP)>=K$(BP) THEN GOTO
 1609
1604 LET T$=K$(FP)
1605 LET K$(BP+1)=K$(BP)
1606 LET BP=BP-1
1607 IF BP>0 THEN IF T$<K$(BP) T
HEN GOTO 1605
1608 LET K$(BP+1)=T$
1609 LET FP=FP+1
1610 IF FP<=NK THEN GOTO 1602
1611 RETURN

1700 REM SHELLSORT
1701 LET I=2**INT (LN (NK-1)/LN
2)
1702 GOSUB 1800
1703 LET I=I/2
1704 IF I>=1 THEN GOTO 1702
1705 RETURN
```

The illustration of the working of the new procedure shows a sequence of events very similar to those which occurred last time. However, each exchange is now reduced to a move, the moving down of a key. Each set of secondary comparisons implies just two further moves, the removal of the key to be moved up at the start and its replacement at the end, of the set of secondary comparisons.

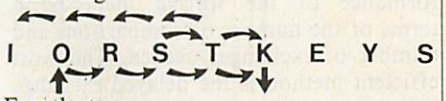
Using ↓ to represent the removal of a key, ⇝ to represent the moving down of a key and ↑ to represent the replacement of a key, the sequence of events is as follows:

First stage

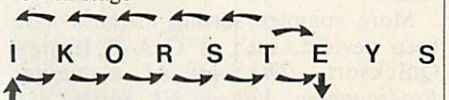
Second stage



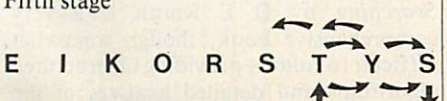
Third stage



Fourth stage



Fifth stage



At the end of the fifth stage the keys are in the following order

E I K O R S S T Y

(continued on next page)

Table 1. Performance of sorts given ordered, reverse ordered and random lists.

List: A B C D B E F G H I J K L M N O P Q R	(1)	(2)	(3)	(4)	(5)	(6)
comparisons	153(271)	17(59)	17(59)	17(59)	17(59)	17(59)
exchanges	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
List: R Q P O N M L K J I H G F E D C B A						
comparisons	153(271)	153(87)	153(83)	153(83)	153(69)	153(69)
exchanges	153(21)	153(21)	153(21)	153(21)	153(21)	62(21)
List: C M O N Y B M O J F H W Y X A J Q Q						
comparisons	153(271)	150(134)	125(125)	114(96)	79(74)	79(74)
exchanges	64(23)	64(23)	64(23)	64(23)	64(23)	30(20)
List: F K U F S M B R G E N M Q E O S A U						
comparisons	153(68)	153(68)	137(68)	95(68)	83(68)	83(74)
exchanges	68(21)	68(21)	68(21)	68(21)	68(21)	32(19)
List: P T S V P B X O I H K B U M E N A C						
comparisons	153(27)	153(142)	151(127)	140(119)	122(81)	122(81)
exchanges	107(30)	107(30)	107(30)	107(30)	107(30)	45(26)
List: F A G Z S I T J C D I S E R N U S T						
comparisons	153(271)	125(113)	98(108)	90(104)	68(79)	68(79)
exchanges	52(26)	52(26)	52(26)	52(26)	52(26)	27(23)
List: P U V R S A F I C E E Y J C X J N V						
comparisons	153(271)	138(119)	117(105)	114(97)	90(76)	90(76)
exchanges	74(25)	74(25)	74(25)	74(25)	74(25)	34(23)
List: M I O L C G G F I R G U O Y A K V X						
comparisons	153(271)	150(134)	117(117)	86(102)	69(75)	69(75)
exchanges	55(25)	55(25)	55(25)	55(25)	55(25)	27(22)

(1) straight exchange sort; (2) ripple sort with logical flag; (3) ripple sort with integer flag; (4) shaker sort; (5) shuttle sort; (6) delayed exchange sort. The figures in brackets refer to algorithms run with the shell sort technique.

Know your sort

(continued from previous page)

The downward scan has reached the end of the list and so the sort is complete; in terms of the algorithm FP > NK. The total number of comparisons is 21 and the total number of exchanges is 8. The improved method has in this case reduced the number of exchanges by six, and this increase in efficiency is reflected in the usual analysis.

The minimum and maximum numbers of comparisons are the same for this method as for the shuttle sort, for exactly the same reasons. So the minimum is N − 1 and the maximum is N − 1 + (N − 1)* (N − 2)/2 = (N − 1)* N/2.

When the list is ordered, none of the primary comparisons results in any moves or secondary comparisons. So the minimum number of exchanges is 0. When the list is reversed, each of the primary comparisons results in three moves: extract the current key, move down its predecessor, insert the key when the top of the list is reached. Each of the secondary comparisons results in one move: move down the next key up. So the maximum number of exchanges is N − 1 + 1/3* (N − 1)* (N − 2)/2 = (N − 1)* (N + 4)/6.

In the general case, the number of exchanges is reduced by about one-half in the new procedure. There seems to be little room left for improvement to this much improved basic sort, but there is a device which can further reduce the number of comparisons and exchanges. It is not so much another sorting procedure as a technique which could be used in conjunction with any of the six procedures already described.

All the methods, except for the first, perform much better with an ordered list than with a reversed one. Similarly, a list which is fairly well ordered, with few keys far from their final position, will result in fewer comparisons and exchanges than a list which is badly ordered. Obviously, the further a key is from its proper place, the greater the number of comparisons and exchanges necessary to move it there.

The problem is that it is adjacent keys which are compared and exchanged. This is just right for keys which are only misplaced by one position, but very slow for keys which are misplaced by, say, 10 positions. By comparing and exchanging keys which are not adjacent it would be possible to make some kind of coarse adjustment, resulting in a list which is less badly ordered and so more amenable to the fine adjustment of comparing and exchanging keys which are adjacent.

This is just what the shell sort does. Given a list of N keys, it starts by finding the largest power of 2 which is less than N — P, say — and runs through the list comparing, and exchanging if necessary, keys which are P positions apart.

It then divides P by 2 and repeats the process. It continues with successively smaller values of P until P is equal to 1, when it is comparing adjacent keys. The difference between this method and that of comparing and exchanging only adjacent keys is somewhat analogous to that between the binary and serial search techniques.

The algorithm for the shell sort is shown in figure 3. The variables are:

NK — number of keys
K$(NK) — list of keys
I — increment: comparisons are to be made between keys I positions apart
Int — an intrinsic function which yields the largest integer less than or equal to its arguments
LN — an intrinsic function which yields the natural logarithm of its argument
Sort — an external subroutine which performs a sort given NK, K$(NK) and I.

Step 1 sets I to the largest power of 2 which is less than NK. Step 3 calls a sorting procedure such as any one of the six procedures already described, to sort keys that are I positions apart. Some small alterations are necessary to render the sorting algorithms suitable for use within the shell sort algorithm.

In the straight exchange sort the following steps are changed to:

```
(3) PP: = I + 1
(5) If K$(PP − I) > K$(PP) Then . . .
(7) K$(PP): = K$(PP − I)
(8) K$(PP − I): = T$
(10) PB: = PB − I
(2) Repeat . . . Until PB < I + 1.
```

In the ripple sort with logical flag the following steps are changed to:

```
(4) PP: = I + 1
(6) If K$(PP − I) > K$(PP) Then . . .
(8) K$(PP): = K$(PP − I)
(9) K$(PP − I): = T$
(12) PB: = PB*PF − I (2) Repeat . . . Until
  PB < I + 1
```

In the ripple sort with integer flag the following steps are changed to:

```
(4) PP: = I + 1
(6) If K$(PP − I) > K$(PP) Then . . .
(8) K$(PP): = K$(PP − I)
(9) K$(PP − I): = T$
(12) PB: = PF − I
(2) Repeat . . . Until PB < I + 1
```

In the shaker sort the following steps are changed to:

```
(1) PT: = I + 1
(7) If K$(PP − I) > K$(PP) Then . . .
(9) K$(PP): = K$(PP − I)
(10) K$(PP − I): = T$
(13) PB: = PF − I
(17) If K$(PP − I) > K$(PP) Then . . .
(19) K$(PP): = K$(PP − I)
(20) K$(PP − I): = T$
(23) PT: = PF + I
```

In the shuttle sort the following steps are changed to:

```
(1) FP: = I + 1
(3) BP: = FP − I
(6) T$: = K$(BP + I)
(7) K$(BP + I): = K$(BP)
(9) BP: = BP − I
(5) Repeat . . . Until BP ≦ 0 ˇ K$(BP + I)
  ≧ K$(BP)
```

In the delayed exchange sort the following steps are changed:

```
(1) FP: = I + 1
(3) BP: = FP − I
(7) K$(BP + I): = K$(BP)
(8) BP: = BP − I
(9) K$(BP + I): = T$
```

Assessing the efficiency of this technique is no easy matter. Given an ordered list, it causes more comparisons to be made than would be made without it because it passes more than once through the list. Given a reversed list, it greatly reduces the numbers of comparisons and exchanges — except when used with the straight exchange sort, when the number of comparisons is increased.

Given a random list, it seems invariably to reduce the number of exchanges made by each of the six sorts, and usually to reduce the number of comparisons, except when used with the straight exchange sort.

The efficiency of the technique depends to an extent on the increments used. For instance, suppose that the first increment is almost as large as the number of keys. It is not really likely that the list is so badly ordered that the keys at the bottom should be at the top. Much work has been done to try and find the best increments. It turns out that decreasing powers of 2 are rather poor. According to Knuth, the best way to choose the increments is to let $h_1 = 1$, $h_{s+1} = 3h_s + 1$, and stop at h_t, when $h_{t+2} \geqq N'$. This gives the sequence 1, 4, 13, 40, 121, . . .

For example, if you have 100 keys, use an increment of 13 on the first pass, 4 on the next one, and 1 on the last. Using these increments certainly improved performance, although the shell sort remains inefficient when used on a list which is to any degree ordered.

All the algorithms were run on their own and with the shell sort technique, to arrange a list of 18 letters in alphabetical order. Table 1 demonstrates the performance of the sorting methods in terms of the number of comparisons and number of exchanges needed. The most efficient method is the delayed exchange sort.

More complex sorting methods have been devised, such as C A R Hoare's Quicksort. *The Art of Computer Programming; Volume III: Sorting and Searching* by D E Knuth is a very comprehensive book, though somewhat difficult to follow, providing unstructured algorithms and detailed analyses of the methods discussed. The comprehensive *Sorting and Sort Systems* by H Loring, provides exceptionally lucid discussions of methods.

I'M HAPPY AND PROUD TO PRESENT:

GGK

Open File

This regular section of *Practical Computing* appears in the magazine each month, incorporating Tandy Forum, Apple Pie, Sinclair Line-up and other software interchange pages.

Open File is the part of the magazine written by you, the readers. All aspects of microcomputing are covered, from games to serious business and technical software, and we welcome contributions on CP/M, BBC Basic, Microsoft Basic, Apple Pascal and so on, as well as the established categories.

Contributors receive £30 per published page and pro rata for part pages, with a minimum of £6. Send contributions to: Open File, *Practical Computing*, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Commodore Corner: Flipping Pet screens; Pop command; Selective Restore; Competition "skill and judgement"; Monitor hardware fix 151

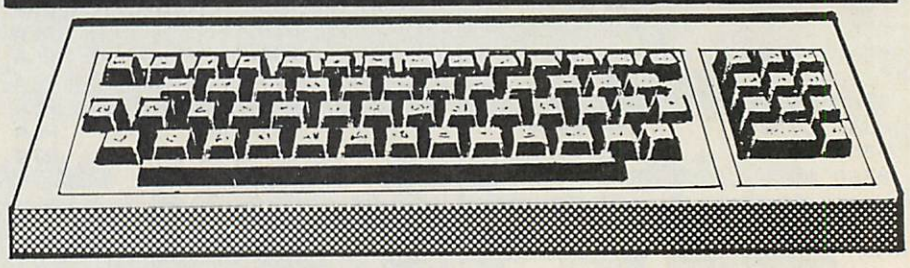
Tandy Forum: Commas for Gotos; Race 2000 game; Inserting Basic lines 158

BBC Bytes: Space Invaders bug; Graph plotting; One-line word processor 165

Research Machines Review: Graphics input 168

Apple Pie: Simon game; Enhanced file indexing 171

End of File: Dragon 32 high-resolution dump; Curve integration routine; Recursive anagram; Save and Load on UK 101; Simon on Dragon 32 174



Guidelines for contributors

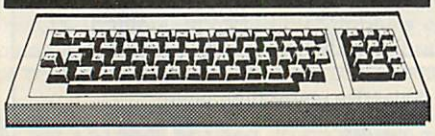
Programs should be accompanied by documentation which explains to other readers what your program does and, if possible, how it does it. It helps if documentation is typed or printed with double-line spacing — cramped or handwritten material is liable to delay and error.

Program listings should, if at all possible, be printed out. Use a new ribbon in your printer, please, so that we can print directly from a photograph of the listing and avoid typesetting errors. If all you can provide is a typed or handwritten listing, please make it clear and unambiguous; graphics characters, in particular, should be explained.

We can accept material for the Pet, Vic and Sharp MZ-80K on cassette, and material for the larger machines can be sent on IBM-format 8in. floppy discs.

COMMODORE CORNER

by Mike Todd



Flipping Screen

THE FIRST three programs this month are simple utilities. Although all three reside in the second cassette buffer they are all fully relocatable. You could put them in any unused and protected area of memory just by changing the start address which appears in line 1000.

The first of the utilities, from Miss Bunn of Stourbridge, West Midlands, is a screen flip, which has a variety of uses. It swaps the contents of the screen with the contents of the top 1,000 bytes of memory and it is so fast that it effectively gives you a second screen.

The routine is actually written for an 8K Pet and stores the screen image from location 7192 onwards. If you want to use a 16K or 32K Pet then the 16th byte, at the end of line 2000 in the program, needs to be changed according to the table.

It is also necessary to protect the top 1,000 bytes from being overwritten by Basic, and this is done using:

POKE 52,A: POKE 53,B: CLR

at the very start of your program, where the values A and B are found from the table.

This routine will work on all 40-column Pets, although for very early old-ROM Pets you should Poke locations 134/135 instead of 52/53. Every time you want to flip to the alternate screen, just use Sys826.

Popping out

Many micros have a Pop command which allows you to remove the last Gosub entry from the stack. It can be useful if you want to abort a subroutine without returning to the calling statement.

Christopher Carter of Formby in Merseyside has sent an equivalent routine for the Pet which is designed for use on Basic 2/3 Pets, but could be used on others by changing the two subroutine calls according to the table.

It is called with Sys826 and will produce a

(continued on next page)

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Flipping screen.

```
1000 S = 826
1010 READ A: IF A>255 THEN 1030
1020 POKE S,A: C=C+A: S=S+1: GOTO 1010
1030 IF A<>C THEN PRINT"CHECKSUM ERROR"
2000 DATA 169,  0,133,  0,169,128,133,  1,169, 24,133, 48,133, 52,169, 28
2010 DATA 133, 49,133, 53,160,  0,169,  0,177,  0,133, 50,177, 48,145,  0
2020 DATA 165, 50,145, 48,200,208,241,230,  1,230, 49,165,  1,201,132,208
2030 DATA 231, 96
2040 DATA 5517
```

```
033A A9 00      LDA #$00
033C 85 00      STA $00
033E A9 80      LDA #$80
0340 85 01      STA $01
0342 A9 18      LDA #$18
0344 85 30      STA $30
0346 85 34      STA $34
0348 A9 1C      LDA #$1C
034A 85 31      STA $31
034C 85 35      STA $35
034E A0 00      LDY #$00
0350 A9 00      LDA #$00
0352 B1 00      LDA ($00),Y
0354 85 32      STA $32
0356 B1 30      LDA ($30),Y
0358 91 00      STA ($00),Y
035A A5 32      LDA $32
035C 91 30      STA ($30),Y
035E C8         INY
035F D0 F1      BNE $0352
0361 E6 01      INC $01
0363 E6 31      INC $31
0365 A5 01      LDA $01
0367 C9 84      CMP #$84
0369 D0 E7      BNE $0352
036B 60         RTS
```

Popping out.

```
1000 S = 826
1010 READ A: IF A>255 THEN 1030
1020 POKE S,A: C=C+A: S=S+1: GOTO 1010
1030 IF A<>C THEN PRINT"CHECKSUM ERROR"
2000 DATA 162,255,133, 71, 32,170,194,154
2010 DATA 201,141,240,  3, 76,232,199,104
2020 DATA 104,104,104,104,96
2030 DATA 2879

033A A2 FF      LDX #$FF
033C 85 47      STA $47
033E 20 AA C2   JSR $C2AA
0341 9A         TXS
0342 C9 8D      CMP #$8D
0344 F0 03      BEQ $0349
0346 4C E8 C7   JMP $C7E8
0349 68         PLA
034A 68         PLA
034B 68         PLA
034C 68         PLA
034D 68         PLA
034E 60         RTS
```

(continued from previous page)

Return Without Gosub error message if there is no Gosub entry on the stack. Purists may say that there should be no need for such things in a well-structured program — but I'm sure someone will find a use for it.

Selective restoration

Also from Christopher comes a selective Restore routine which allows a Read statement to start at a given line of data. This would otherwise have to be done with a For-Next loop to search for the start of the desired data, which can be long and tedious.

The routine is called by using Sys826, X where X is the line number at which you want to start reading. If the line number does not exist, or if there is no Data statement on it, the routine just ignores the instruction.

This routine is also for Basic 2/3 Pets, but can be converted using the table.

Skill and judgement

Are you a competition nut? Do you enter every multiple choice competition that you see? You know the sort, "using your skill and judgement, arrange the following attributes into order and win ..." If you do, then Nick Higham of Eccles has produced a program to help you.

Most of these competitions allow multiple entries and, having chosen the preferred order of entries, permuting these to produce an entry can be very tedious. This program simplifies it all and after telling it how many

(continued on page 157)

Selective restoration.

```
1000 S = 826
1010 READ A: IF A>255 THEN 1030
1020 POKE S,A: C=C+A: S=S+1: GOTO 1010
1030 IF A<>C THEN PRINT"CHECKSUM ERROR"
2000 DATA  32,112,  0, 32,139,204, 32,210
2010 DATA 214, 32, 44,197,144, 33,160,  4,177
2020 DATA  92,240, 27,200,201,131,208,247
2030 DATA 165, 17,133, 60,165, 18,133, 61
2040 DATA 136,152,166, 93, 24,101, 92
2050 DATA 144,  1,232,134, 63,133, 62, 96
2060 DATA 5493

033A 20 70 00    JSR $0070
033D 20 8B CC    JSR $CC8B
0340 20 D2 D6    JSR $D6D2
0343 20 2C C5    JSR $C52C
0346 90 21       BCC $0369
0348 A0 04       LDY #$04
034A B1 5C       LDA ($5C),Y
034C F0 1B       BEQ $0369
034E C8          INY
034F C9 83       CMP #$83
0351 D0 F7       BNE $034A
0353 A5 11       LDA $11
0355 85 3C       STA $3C
0357 A5 12       LDA $12
0359 85 3D       STA $3D
035B 88          DEY
035C 98          TYA
035D A6 5D       LDX $5D
035F 18          CLC
0360 65 5C       ADC $5C
0362 90 01       BCC $0365
0364 E8          INX
0365 86 3F       STX $3F
0367 85 3E       STA $3E
0369 60          RTS
```

Flipping screen table.

	8K	16K	32K
16th byte	28	60	124
Poke 52,A	24	24	24
Poke 53,B	28	60	124

Popping out table.

BASIC2/3	BASIC1	BASIC4
C2AA	C2AC	B322
C7E8	C7D8	B86B

Selective restoration table.

BASIC2/3	BASIC1	BASIC4
CC8B	CCA4	BD84
D6D2	D6DA	C92D
C52C	C522	B5A3

Open File

This regular section of *Practical Computing* appears in the magazine each month, incorporating Tandy Forum, Apple Pie, Sinclair Line-up and other software interchange pages.

Open File is the part of the magazine written by you, the readers. All aspects of microcomputing are covered, from games to serious business and technical software, and we welcome contributions on CP/M, BBC Basic, Microsoft Basic, Apple Pascal and so on, as well as the established categories.

Contributors receive £30 per published page and pro rata for part pages, with a minimum of £6. Send contributions to: Open File, *Practical Computing*, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Commodore Corner: Flipping Pet screens; Pop command; Selective Restore; Competition "skill and judgement"; Monitor hardware fix 151

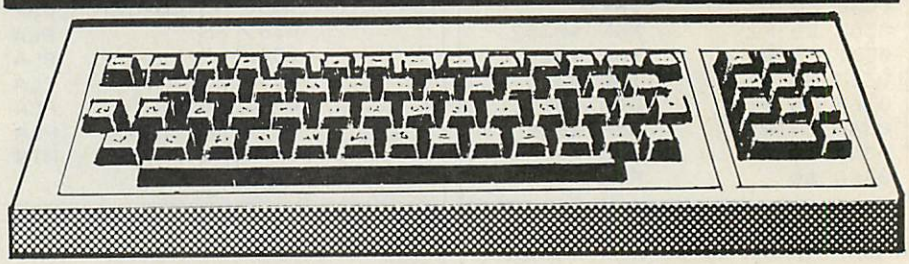
Tandy Forum: Commas for Gotos; Race 2000 game; Inserting Basic lines 158

BBC Bytes: Space Invaders bug; Graph plotting; One-line word processor 165

Research Machines Review: Graphics input 168

Apple Pie: Simon game; Enhanced file indexing 171

End of File: Dragon 32 high-resolution dump; Curve integration routine; Recursive anagram; Save and Load on UK 101; Simon on Dragon 32 174



Guidelines for contributors

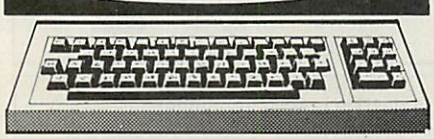
Programs should be accompanied by documentation which explains to other readers what your program does and, if possible, how it does it. It helps if documentation is typed or printed with double-line spacing — cramped or handwritten material is liable to delay and error.

Program listings should, if at all possible, be printed out. Use a new ribbon in your printer, please, so that we can print directly from a photograph of the listing and avoid typesetting errors. If all you can provide is a typed or handwritten listing, please make it clear and unambiguous; graphics characters, in particular, should be explained.

We can accept material for the Pet, Vic and Sharp MZ-80K on cassette, and material for the larger machines can be sent on IBM-format 8in. floppy discs.

COMMODORE CORNER

by Mike Todd



Flipping Screen

THE FIRST three programs this month are simple utilities. Although all three reside in the second cassette buffer they are all fully relocatable. You could put them in any unused and protected area of memory just by changing the start address which appears in line 1000.

The first of the utilities, from Miss Bunn of Stourbridge, West Midlands, is a screen flip, which has a variety of uses. It swaps the contents of the screen with the contents of the top 1,000 bytes of memory and it is so fast that it effectively gives you a second screen.

The routine is actually written for an 8K Pet and stores the screen image from location 7192 onwards. If you want to use a 16K or 32K Pet then the 16th byte, at the end of line 2000 in the program, needs to be changed according to the table.

It is also necessary to protect the top 1,000 bytes from being overwritten by Basic, and this is done using:

```
POKE 52,A: POKE 53,B: CLR
```

at the very start of your program, where the values A and B are found from the table.

This routine will work on all 40-column Pets, although for very early old-ROM Pets you should Poke locations 134/135 instead of 52/53. Every time you want to flip to the alternate screen, just use Sys826.

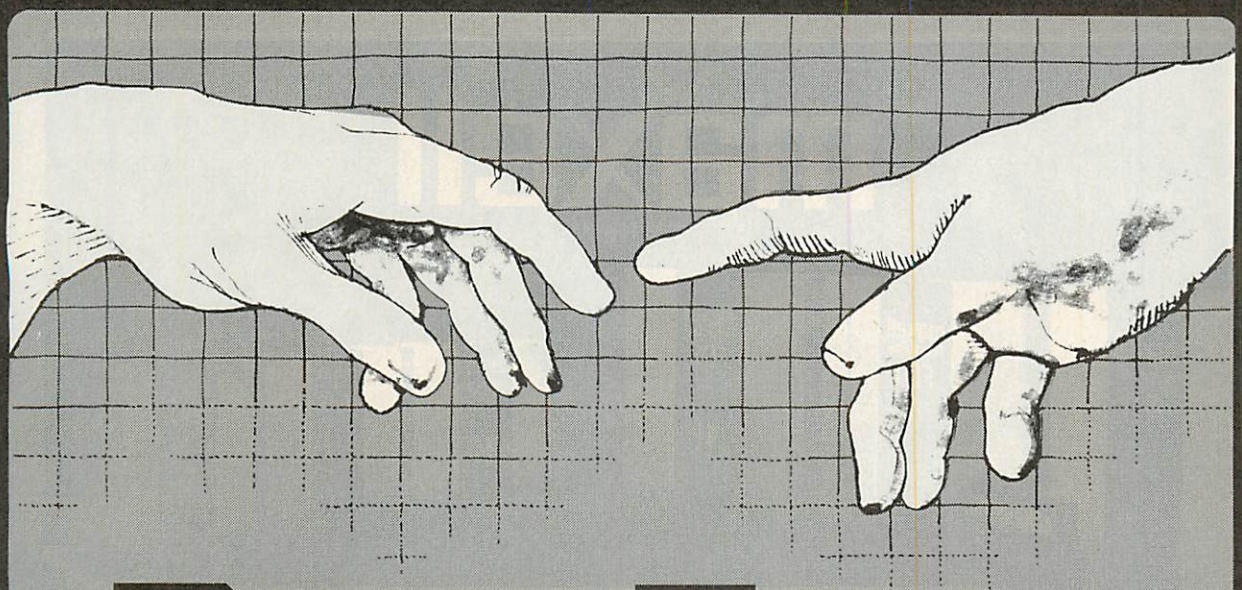
Popping out

Many micros have a Pop command which allows you to remove the last Gosub entry from the stack. It can be useful if you want to abort a subroutine without returning to the calling statement.

Christopher Carter of Formby in Merseyside has sent an equivalent routine for the Pet which is designed for use on Basic 2/3 Pets, but could be used on others by changing the two subroutine calls according to the table.

It is called with Sys826 and will produce a

(continued on next page)



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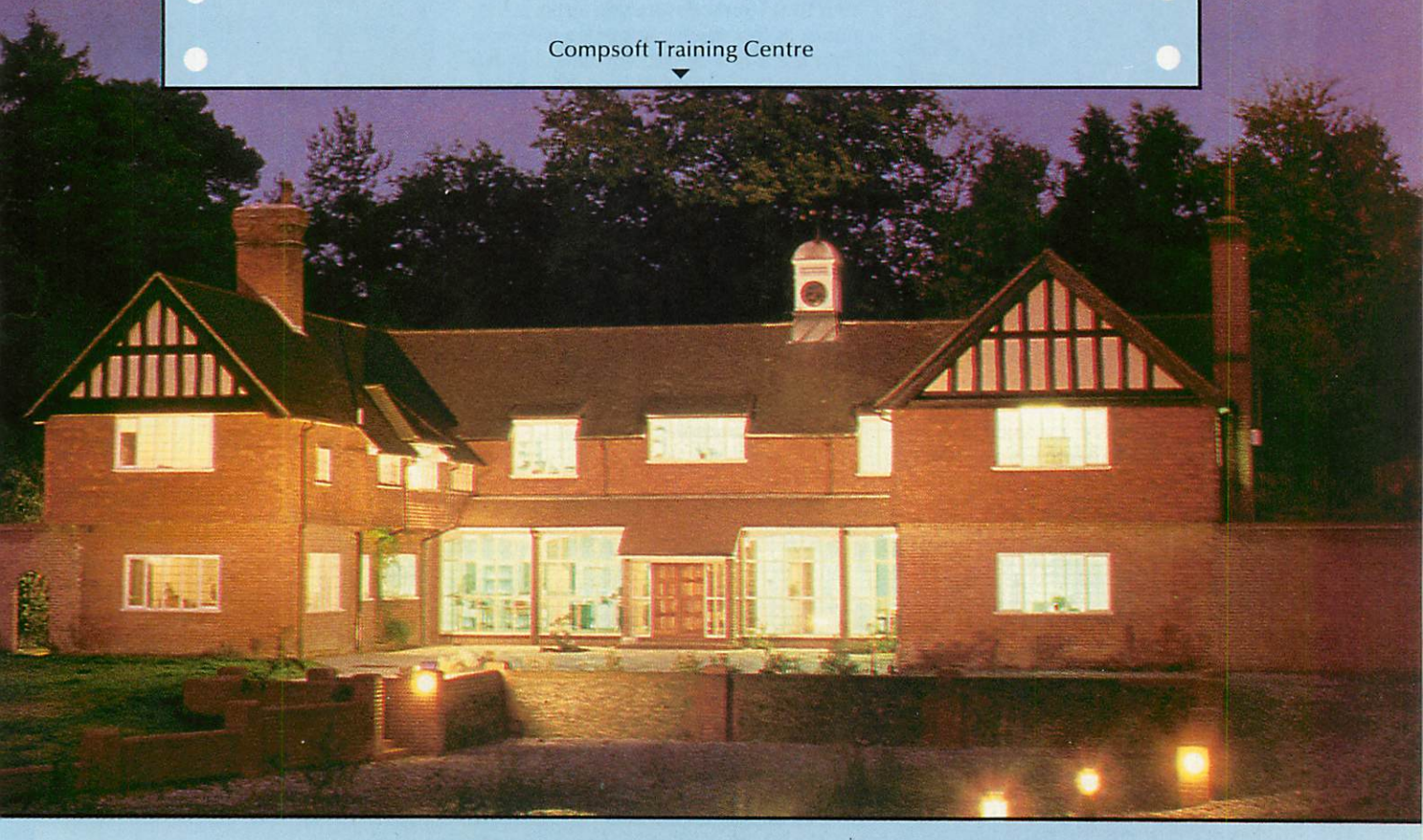

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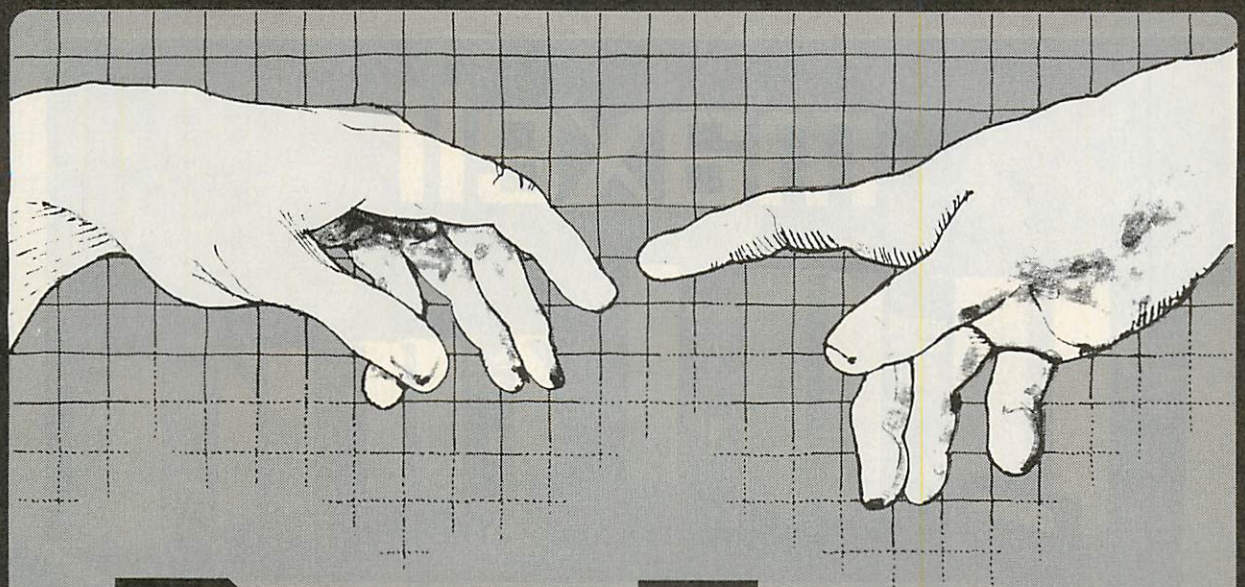

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MicroSoft's flight simulator is awesome. It simulates flying in a little Cessna 182 with astonishing accuracy. In the absence of a joystick the keyboard controls are finnicky — especially as the full game uses about 45 different keys — but nonetheless the plane is incredibly responsive and a joy to fly.

This simulator was designed by Bruce A Artwick, who wrote his Master's thesis on "A Versatile Computer-Generated Dynamic Flight Display" before joining the Hughes Aircraft Corporation. He left to start his own company, Sublogic, and launched the A2-FS1 flight simulator for the Apple II. The IBM PC version from MicroSoft is, apparently, a huge advance on this.

The best thing about it is that fully half of the screen is devoted to a full three-dimensional colour display. You can also switch to sideways, downwards and backwards views, so you really can fly past a building and then look back at it. The IBM redraws the frames without benefit of any special graphics techniques, but quickly enough to present the illusion of continuity — it's almost as good as a movie on video.

The controls are amazing. It is claimed that the display meets full FAA specifications. The control panel is a faithful, detailed replica of the Cessna. You can even control the carburettor heat and the magneto switch.

There are 10 flight modes, including a demonstration mode and an Easy Flight mode. You can also fly in different kinds of weather, or in Advanced mode where the ailerons and rudder are controlled independently. Wind and weather then have more effect.

You set the mode on a two-screen menu which allows you to set all the other parameters, from the barometric pressure and the amount of cloud to the season of the year. You fly in a 24-hour format, so obviously dawn and dusk come at different times in the different seasons. There are 40 spare modes so you can, using the parameter settings, create your own and save them to disc for reuse later.

On booting up you always start at Meigs airport between Chicago Heights and O'Hare airports. You do not have enough fuel to fly across the U.S. but you can switch to start near Los Angeles, Illinois or Seattle. The database includes major buildings and geographical features so you can, flying visually, see where you are.

Finally the documentation is excellent. The disc comes with a book of about 100 pages. The instructions are comprehensive, helpful, and written in good English. There are excellent diagrams, including airplane drawings to show how the ailerons and rudder work.

In sum, the MicroSoft Flight Simulator is fantastically detailed, incredibly versatile, and a truly remarkable graphics program. Every IBM Personal Computer owner should have one.

The Hobbit

THIS IS an impressively packaged Adventure game which makes good use of the Spectrum's colour graphics to draw little pictures of the main locations. The cassette is boxed and comes complete with a copy of Tolkien's novel of the same name, plus a helpful 20-page instruction book.

You are Bilbo and make your way through Middle Earth, meet Gandalf and liberate the Dragon's treasure. Well, more likely you get eaten by a troll, but that's the idea. The interaction with other characters is limited, but above average for an Adventure game. This makes the action turn out slightly differently in each game.

The input routines accept instructions that are closer to English than usual, and you can enter several together. For convenience you can enter simple directions as single letters, or use the cursor-control keys, unshifted. The back of the instruction book contains a list of the 68 dictionary words the game understands — which saves endless hours of trying every word you can think of in the hope that something will work.

If you stop entering commands, after a while you get a wait entry, and the game goes on without you. For example, "You wait. Time passes. Gandalf closes the round green door." Later, "You wait. Time passes. Gandalf gives the curious map to you. Thorin waits." And later, "You wait. Time passes. Gandalf goes north." "You wait. Time passes." You wait. Time passes. Thorin says 'Hurry up!' "

The Hobbit was written by Philip Mitchel and Veronika Megler, with Alfred Milgrom and Stuart Ritchie, over a period of 18 months. They have not only produced one of the best games for the Spectrum, but given everyone else a lesson in good game design. Only one criticism: it's a pity the trolls do not spell better.

Specification

Type: Adventure game, text with some colour graphics and real-time components.
Format: cassette
System: 48K Spectrum
Manufacturer: Melbourne House, 131 Trafalgar Road, London SE10
Price: £14.95
Rating: 16/20

Defender

IT'S VERY HARD to review Defender, mainly because it's very hard to stop playing it. It is one of those games that, while luck plays a part, recognises and rewards skill. You just know you can get a better score next time. "Just one more go" can keep you up half the night.

Like many of Atari's best games it is readily available in the arcades, so if you are one of the unfortunate few who is not familiar with it, go and look now. Take a couple of pounds, because it is not easy to get the hang of it. First you have to learn the controls, then adopt a Zen attitude of detached tranquility and blast everything on sight.

The Atari version is played with a joystick instead of a lever and Thrust and Reverse buttons. Moving the joystick left or right sends your Defender left or right. To fire, press the joystick button. The smart bomb is operated by the space bar, and you jump through space by hitting any other key except Shift, etc.

In other respects, the Atari Defender seems to be a nearly exact copy of the arcade game. Movement on the Atari version is faster and smoother, but of course the screen is smaller. In particular, mutant humanoids are more vicious, but you soon learn how to deal with them ...

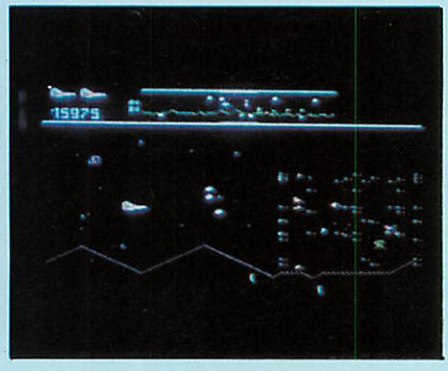
Unlike the arcade game, however, the home-computer version offers three different levels of play — easy, normal and hard. I only tried easy. Two-player versions and a demonstration mode are also included.

There is only one thing lacking: the computer does not record your highest score, let along best today or best of all time. This may be because it is not possible to fit more than 16K into a cartridge, and there just is not room for it.

Even so, Defender is outstanding, and could the the second-best home computer game ever written — after the immortal Star Raiders, of course.

Specification

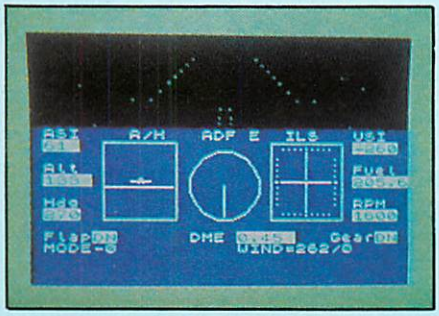
Type: Real-time arcade game with outstanding colour and sound.
Format: Plug-in ROM pack CXL-4025
System: Any Atari 400 or 800 plus joystick
Manufacturer: Atari
Price: £34.95
Rating: 18/20



Flights of fancy

Jack Schofield gives his fantasies free rein with an assortment of simulation games.

SIMULATION is one of the most interesting aspects of computing, and advanced graphics techniques have been pioneered commercially by flight-simulation experts such as Rediffusion. Many personal-computer owners can also "learn" to fly using a simulation program, though the actual aim is entertainment rather than instruction. To establish the range of the field I tried three: Nightflight for the Sinclair Spectrum, Jumbo Jet Pilot for the Atari, and MicroSoft's flight simulator for the IBM Personal Computer.



Nightflight on the Spectrum.

Nightflight comes on cassette and loaded on the third attempt — about par for the course with the Spectrum. It presents a menu of options including two demonstration modes, take-off and landing modes, and flying by two different types of navigation.

Graphically the simulation is about as good — or as bad — as you would expect: it is rather primitive, but not bad considering the limitations of the Spectrum. The cockpit view is a narrow strip at the top of the screen. As this is a night flight, it is plain black most of the time. There's also a map screen you can switch to, but it is confusingly presented.

The cockpit controls are also hard to follow, and the poor instruction sheet lacks a diagram. The blurb says Nightflight was written by a pilot. I believe it. He should have got a total ignoramus to write the instructions and so explain the stuff to the rest of us who aren't. As usual, the Spectrum sound is pathetic. However, the light plane is quite responsive, and that makes the weaknesses acceptable.

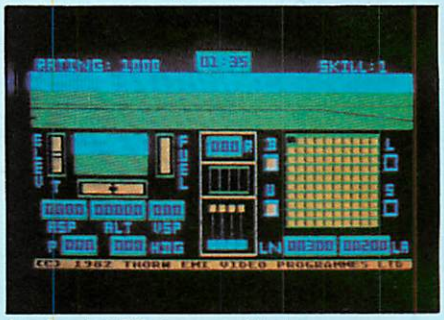
Jumbo Jet Pilot from Thorn EMI is a very different effort. Being written for the more powerful Atari 400 and 800 micros, the graphics are vastly superior. The simulation itself is also far more detailed, and the controls far more complicated. For example, elevating the flaps lifts the nose and this registers, along with a change in cockpit view, before it starts to affect altitude. There is also a map mode, which is simple but perfectly adequate.

Jumbo Jet Pilot comes on a plug-in ROM, so loading is simplicity itself. Control is partly by the keyboard, but also uses a standard joystick which makes it much more user-friendly.

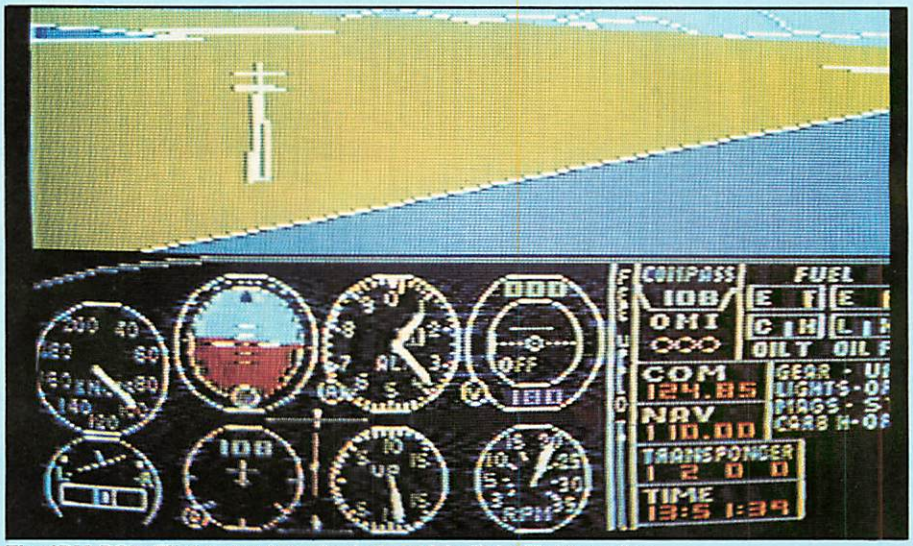
The problem with Jumbo Jet Pilot is that it is unbelievably tedious to play. The plane is not responsive to the controls: you need 10 minutes to take off and about an hour to fly to the destination airport. It's almost as though the simulation was in real-time. I'm surprised you don't have to queue on the runway or get delayed by strikes.

I tried two flights. The second time I didn't bother with the runway — you can take off anywhere. I did not spot any landmarks between the two airports so the landscape appears uniformly green and boring, and the night-flight option is the same. The sound is also unimaginative.

Incidentally, the instructions are very poor compared with those for Atari's own games. They do at least contain a tiny diagram of the controls, labelled from a to p, but are hardly easy to read.



Jumbo Jet Pilot on an Atari.



The IBM PC's Flight simulator includes 10 built-in flight modes.

Flight-simulator specifications

	Nightflight	Jumbo Jet Pilot	Flight Simulator
Type: real-time flight simulation with colour graphics and some sound			
Format:	cassette tape	plug-in ROM	5.25in. floppy disc
System:	48K Spectrum	Atari 400 or 800 with joystick	IBM PC with colour-graphics adaptor
Manufacturer:	**Hewson Consultants,** 60A St Mary's Street, Wallingford, Oxfordshire OX10 OEL	**Thorn EMI,** Thorn EMI House, Upper St Martin's Lane, London WC2	**MicroSoft,** Bulbourne House, Gossoms End, Berkhamsted, Hertfordshire
Price:		£34.95	$50
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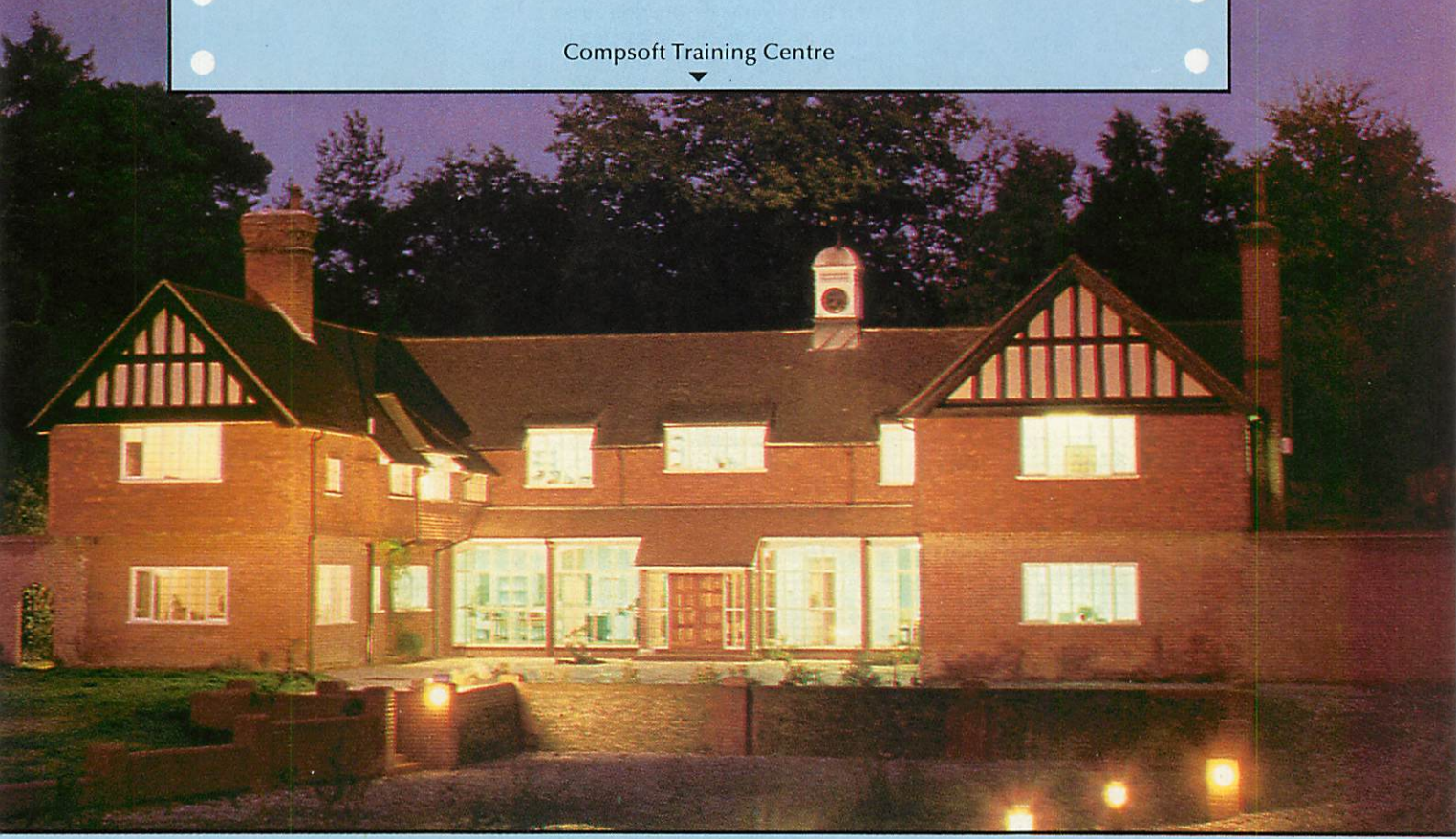

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Recursive Kalman filters

(continued from previous page)

process state variable x_k and the state variable estimate $\hat{x}_o$. The program then asks for the initial value of the estimation error variance $p_o(-)$, and finally for the maximum and minimum values you wish the screen vertical axis to represent.

In practice, the initial values of the state-variable estimate and the estimation error variance are not known, so the initial estimate is a pure guess. Consequently the initial estimation error variance must be set to a high value, 10E06 for example, in order to tell the filter that you have little confidence in the initial guess. Of course in this simulation you do know what the actual initial state variable value is because you are also simulating the system itself. You can set x_o and $\hat{x}_o$ to the same value if you like, or use different values to see if the filter estimates converge to somewhere near the system values.

The program makes use of the Apple II high-resolution graphics screen to plot the system state variable and the filter's estimate of it, with the time axis of the filter estimate shifted 60 lines above the actual state-variable time axis for clarity. They should, of course, be plotted on top of each other, but on a black and white monitor it would be difficult to distinguish estimate from actual state. Because the RND function in Applesoft Basic has an approximately flat probability-distribution profile the program incorporates a small routine to generate roughly Gaussian random variables in order to simulate the Gaussian white noise present in the measurement and input.

The input to the system is simulated using the games paddle 0; turning it to a different position will cause the state to converge to a different steady-state value. The filter estimate should follow suit within a couple of time steps. Moving the games paddle to a new position is equivalent to changing the air temperature in the thermocouple simulation. The filter gain G_k is printed below the high-resolution screen after every time step.

The gain converges to a steady value after a few time steps even if the system itself is unstable and the state variable increases exponentially with time. The recursive filter equations are often dispensed with, and the constant gain is pre-computed and used instead in the recursive filter estimation equation in figure 5. All the other recursive filter gain equations in figure 3 then become unnecessary. Try running the simulation and note the value that G converges to. Then alter the program so that this is used from the beginning, and run it again. There is very little difference in the filter performance.

If you use the thermocouple model parameters in the simulation program summarised in table 1, then the program produces a plot like that given in figure 9. The filter estimate of v_k is good. Remember that the filter is estimating v_k purely from the noisy measurement y_k. In this case the filter is not being taxed much since the measurement noise is low, and so the measurement is a good indicator of the actual value of v_k.

The Kalman filter really becomes useful when the measurement noise level is higher and you want to filter out the measurement noise to get a good estimate of the state variable. Try rerunning the simulation, but this time pretend that the measurement noise is higher by specifying a larger measurement-noise variance. The filter estimate is still very good, even for much higher measurement noise variances.

This model is based on an actual thermocouple consisting of two wires of NiCr and NiAl of 0.114mm. diameter. The dynamic equation describing the thermocouple is:

$dv/dt = 9.59v + 0.39(T + \text{random noise})$

where v is the potential difference produced by the thermocouple in mV, T is the temperature of the air in the duct. The random noise which is added to the temperature varies about a mean of zero.

The measurement model is given by:

$y = 1000v + \text{random noise}$

The amplifier gain is 1,000

The discrete version of this equation for a time step of 0.1s is:

$v_{k+1} = 0.383v_k + 0.025(T + \text{random noise})$

and

$y_k = 1000v_k + \text{random noise}$

The variances of the noises in the temperature and the measurement are:

variance of temperature noise = 8.0

variance of measurement noise = 0.0025

Figure 7. The dynamic model of the thermocouple temperature measurement system for the hot-air duct example.

Recursive filter estimation equation stays exactly the same, since noise is not taken into account by the deterministic filter model of the system.

One of the gain equations is slightly altered:

$p_{k+1}(-) = \Phi^2 p_k(+) + \Delta^2 W$

where W is now the variance of the input noise of the following system.

$x_{k+1} = \Phi x_k + \Delta(u_k + w_k)$

where w_k is the input noise.

Figure 8. Modifications to the Kalman filter equations if the noise is produced in the input rather than in the process itself.

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Figure 6.

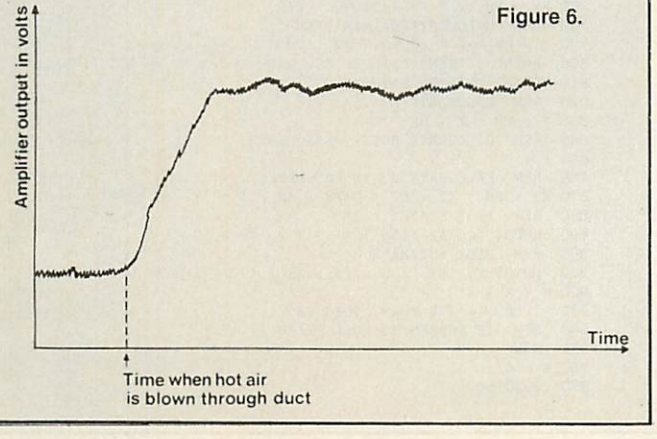
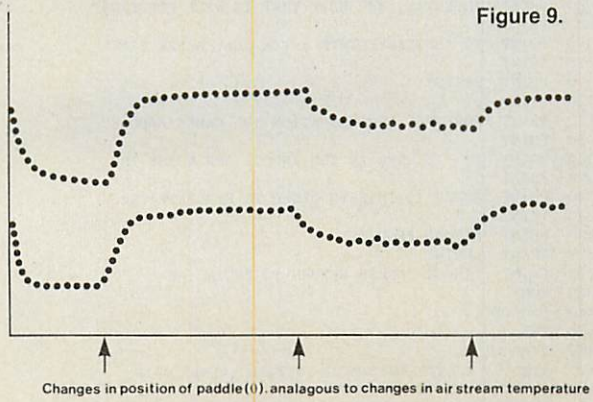


Figure 9.



prediction of x_k, that is the latest estimate of x_k based on k measurements.

If you examine figure 4, you will see that the filter evaluates the error between the measurement of the process and the measurement as predicted by the model of the process on the computer. The error is then fed to the model in order to control the error in the state-variable estimate. The whole technique is thus in effect a feedback loop, and hence self-compensating. It is actually recursive, and draws on the past estimate in order to compute the present estimate.

The recursive feature means that past trends are automatically taken into account in the evaluation of the latest estimate, so the technique is vary fast. Figure 4 shows how the predicted measurement error $\hat{e}_{k+1}(-)$ is multiplied by a weighting factor, or gain, G which is recursively calculated from the Kalman filter equations, which are given in figure 5. The filter equations are quite straightforward, and because of their recursive nature do not require storage of previous values of the gain G or previous values of the state variable estimate $\hat{x}$.

If you have an analogue-to-digital converter interfaced to your micro, you could use the Kalman filter to estimate an unknown state variable of some process from a noisy measurement. You will have to model the process mathematically first. It is possible to use the computer to simulate both the sytstem and the filter to show how the Kalman filter works without actually needing the hardware for on-line measurements of a system. The simulation given here is based on thermocouple readings of the temperature of air flowing through a duct. Turbulence in the air stream makes the temperature fluctuate randomly about a mean value, and there is also some electrical noise generated by the thermocouple and amplifier circuit.

The thermocouple can be modelled as a first-order system. If it is placed in the duct and the temperature of the air is suddenly changed, then the voltage output from the thermocouple amplifier looks like that shown in figure 6. The voltage rises steeply before the output settles to a steady state which is modified by random fluctuations.

The model equations for this system are given in figure 7. The first-order differential equation is converted to a difference equation for use in the discrete filter. The air temperature acts as an input to the system, and random fluctuations in air temperature are strictly speaking input noise rather than process noise. This distinction is reflected in changes to the filter equations — see figure 8. The variance in the input noise has been calculated as approximately 8, and the variance of the measurement noise as 0.0025: the main source of the noise is therefore from the air-stream temperature fluctuations.

The problem here is to estimate the thermocouple voltage v_k from the noisy measurement voltage y_k. Once you know v_k then you can, if you wish, calculate the air stream temperature using the relationship for this particular type of thermocouple:

$$t_k(\text{in °C}) = 25v_k(\text{mV})$$

An Applesoft program is given in the listing which will perform a filter simulation for a general first-order system. The program asks for the parameters Φ and Δ of the dynamic equation which describes the system and uses these values for the filter model. Next you have to input the noise variances, the initial values of the actual

(continued on next page)

The discrete version of the linear equations in figure 3 are:

$x_{k+1} = \Phi x_k + \Delta u_k + w_k$

$y_k = Cx_k + v_k$

$W = E(w_k^2)$ and $V = E(v_k^2)$ are the noise variances, which are known; w_k and v_k are assumed not to be totally independent of each other. The recursive filter estimation equation is:

$\hat{x}_{k+1}(+) = \Phi\hat{x}_k(+) + \Delta u_k + G_{k+1}[y_{k+1} - C(\Phi\hat{x}_k(+) + \Delta u_k)]$

The recursive filter gain equations are:

$G_{k+1} = (Cp_{k+1}(-) \div (C^2p_{k+1}(-) + V)$

$p_{k+1}(-) = \Phi^2p_k(+) + W$

$p_k(+) = [1 - G_kC]p_k(-)$

with the initial condition

$p_o(-) = E[(x_o - \hat{x}_o)^2]$

Figure 5. The Kalman filter equations for a scalar system like that given in figure 3.

```
10  TEXT
20  HOME
30  PRINT "PROGRAM TO DEMONSTRATE THE KALMAN FILTER"
40  PRINT "FOR A FIRST ORDER SYSTEM"
50  PRINT : PRINT : INPUT "INPUT PHI    ";PH
60  PRINT : INPUT "INPUT DELTA  ";DE
70  PRINT : INPUT "INPUT C      ";C
80  PRINT : PRINT : INPUT "INPUT THE VARIANCE OF THE INPUT NOISE    ";VI
90  PRINT : PRINT : PRINT "INPUT THE VARIANCE OF THE MEASUREMENT"
100  INPUT "NOISE    ";VM
110  HOME
120  PRINT "INPUT THE INITIAL VALUE OF THE"
130  INPUT "STATE VARIABLE  ";X
140  PRINT "INPUT THE INITIAL VALUE OF THE"
150  INPUT "STATE VARIABLE ESTIMATE  ";XE
160  PRINT : PRINT
170  PRINT "INPUT THE INITIAL VALUE OF THE"
180  INPUT "VARIANCE OF THE ESTIMATION ERROR  ";PM
190  PRINT
200  PRINT "NOW DEFINE SCREEN MATHEMATICAL SPACE"
210  PRINT : INPUT "INPUT UPPER VALUE ";UV
220  PRINT : INPUT "INPUT LOWER VALUE ";LV
230  HOME
240  PRINT "IN THIS DEMONSTRATION THE FILTER GAIN IS"
250  PRINT
260  PRINT "BEING CALCULATED ON LINE AT EACH TIME"
270  PRINT
280  PRINT "INTERVAL, BUT NOTE THAT IT WILL CONVERGE"
290  PRINT
300  PRINT "TO A STEADY STATE AFTER ONLY A FEW TIME"
310  PRINT
320  PRINT "STEPS"
330  PRINT
340  PRINT "FOR THIS DEMONSTRATION THE GAMES PADDLE"
350  PRINT
360  PRINT "(0) IS USED AS THE INPUT, AND NOISE IS"
370  PRINT
380  PRINT "ADDED TO THIS IN ORDER TO SIMULATE THE"
390  PRINT
400  PRINT "ACTUAL PROCESS"
410  PRINT : PRINT
420  PRINT : INPUT "PRESS RETURN TO BEGIN";A$
430  HOME
440  HCOLOR= 3
450  HGR
460  VTAB 21
470  REM  CALCULATE AND PRINT INITIAL KALMAN GAIN
480 G = PM * C / (C ^ 2 * PM + VM)
490  PRINT : PRINT "FILTER ESTIMATE SHOWN ABOVE ACTUAL VALUE"
500  PRINT "FILTER GAIN= ";G
510  REM  PLOT INITIAL STATE & STATE ESTIMATE
520 K = 0
530  HPLOT K, INT (159 * (1 - X / (UV - LV)))
540  HPLOT K, INT (159 * (1 - XE / (UV - LV)) - 60)
550 K = K + 4
560  REM  GAMES PADDLE SIMULATES INPUT
570  REM  U CAN HAVE A VALUE BETWEEN 0 & 255
580 U =  PDL (0)
590  REM
600  REM  SLOW DOWN THE PROGRAM TO SEE HOW GAIN CHANGES
610  FOR I = 1 TO 500: NEXT I
620  REM  GENERATE GAUSSIAN RANDOM NOISE VARIABLES
630  REM  V IS THE NOISE IN THE MEASUREMENT
640  REM  W IS THE NOISE IN THE INPUT
650 V = 0:W = 0
660  FOR I = 1 TO 50
670 V = V +  RND (1)
680 W = W +  RND (1)
690  NEXT
700 V =  SQR (12 / 50) * (V - 25) *  SQR (VM)
710 W =  SQR (12 / 50) * (W - 25) *  SQR (VI)
720  REM
730  REM  ADD NOISE TO INPUT
740 U = U + W
750  REM  UPDATE ESTIMATION ERROR VARIANCE
760 PP = (1 - G * C) * PM
770 PM = PH ^ 2 * PP + DE ^ 2 * VI
780  REM  CALCULATE KALMAN GAIN
790 G = PM * C / (C ^ 2 * PM + VM)
800  PRINT : PRINT "FILTER ESTIMATE SHOWN ABOVE ACTUAL VALUE"
810  PRINT "FILTER GAIN= ";G
820  REM  CALCULATE STATE
830 X = PH * X + DE * U
840  REM  CALCULATE NOISY MEASUREMENT
850 Y = C * X + V
860  REM  CALCULATE STATE ESTIMATE
870 XM = PH * XE + DE * U:XE = XM + G * (Y - C * XM)
880  REM  PLOT STATE
890  HPLOT K, INT (159 * (1 - X / (UV - LV)))
900  REM  PLOT ESTIMATE
910  HPLOT K, INT (159 * (1 - XE / (UV - LV)) - 60)
920 K = K + 4
930  IF K   = 279 THEN  GOTO 580
940  REM  IF SCREEN IS FULL CLEAR IT
950  HGR
960 K = 0
970  GOTO 580
```

Recursive Kalman filters

(continued from previous page)

ments in such a way as to make it impossible to estimate the state vector x at all. The system is then unobservable and unless you can specify different measurements you will not be able to use a Kalman filter. But the majority of cases are observable, and there is a test to check that they are.

Rather than consider the multivariable filter, it is easier to look at the single-variable or scalar case. The extension of the scalar filter equations to the multivariable case is quite straightforward. Figure 3 gives the model equations for a scalar stochastic system. The covariances referred to in figure 2 are just the multivariable equivalent of the scalar variance. Although you do not know the values of the process and measurement noises directly, you must have some idea of the magnitude of the noises in order to use a Kalman filter and so you must know what the noise variances are. In many practical cases the variances of the noises are not known exactly, but educated guesses or values taken from past experiments often suffice.

Most applications of Kalman filters are on digital computers, so it is necessary only to consider what is called discrete filtering. Both the model and filter equations are given in terms of equations rather than differential equations, because a computer will have to sample the measurements at discrete intervals, and then perform any calculations between the intervals. The system itself can still be a continuous process of course, while the filter works in discrete jumps.

If you have a continuous model of the process in terms of a differential equation you will have to rewrite the differential equation as a difference equation. If the sampling interval is small, it is usually sufficient to use the approximation for dx/dt:

$$dx/dt \simeq (x_{k+1} - x_k)/\delta t$$

where δt is the sampling time, that is the time between sampling intervals k and k+1. Thus for example, $dx/dt = 10x + u$ could be written as:

$$(x_{k+1} - x_k)/\delta t = 10x_k + u$$

which rearranges to:

$$(x_{k+1} = 10\delta t + 1)x_k + \delta t u$$

So if $\delta t = 1$ second, for example, then:

$$x_{k+1} = 11x_k + u$$

which can be written as:

$$x_{k+1} = \Phi x_k + \Delta u$$

where $\Phi = 11$ and $\Delta = 1$. If the model is not a first-order differential equation but of higher order the higher-order differential equation can be written as a group of simultaneous first-order differential equations, though that again is a multivariable case.

A block diagram of the discrete Kalman filter is shown in figure 4. It shows how the filter uses a model of the process internally. This model consists of equations like those in figure 3, but without the noise, since the exact noise values are not known. The filter's internal model is thus a deterministic model of the stochastic system; deterministic means exact, and not governed by the laws of probability.

The circumflex accents above the symbols in figure 4 signify filter estimates, as opposed to the actual system values. The plus and minus signs in brackets show whether the estimates are based on all the measurements made so far (+), or all the measurements apart from the latest one (−). This effectively means that $\hat{x}_k(-)$ is a prediction of x_k based on k−1 measurements, whereas $\hat{x}_k(+)$ is an updated

Φ	0.383
Δ	0.025
C	1000.0
variance of input noise	8.0
variance of measurement noise	0.0025
initial value of the state variable	10.0
initial value of the estimate	0.0
initial value of the variance of the estimation error	10E+06
upper screen value	40
lower screen value	0

Table 1. Typical values to be used with the Kalman filter simulation program for the thermocouple example given in the text.

System equation:

$$\frac{dx}{dt} = Ax + Bu + w$$

Measurement model equation:

$$y = Cx + v$$

where: x is a single variable, called the state variable; y is a scalar measurement made on the system; u is a scalar input to the system; w is a scalar Gaussian random noise in the process itself; v is a scalar Gaussian random noise in the measurement; A, B and C are scalar coefficients. The variances W and V of the noises w and v are assumed known. (Variance is defined as:

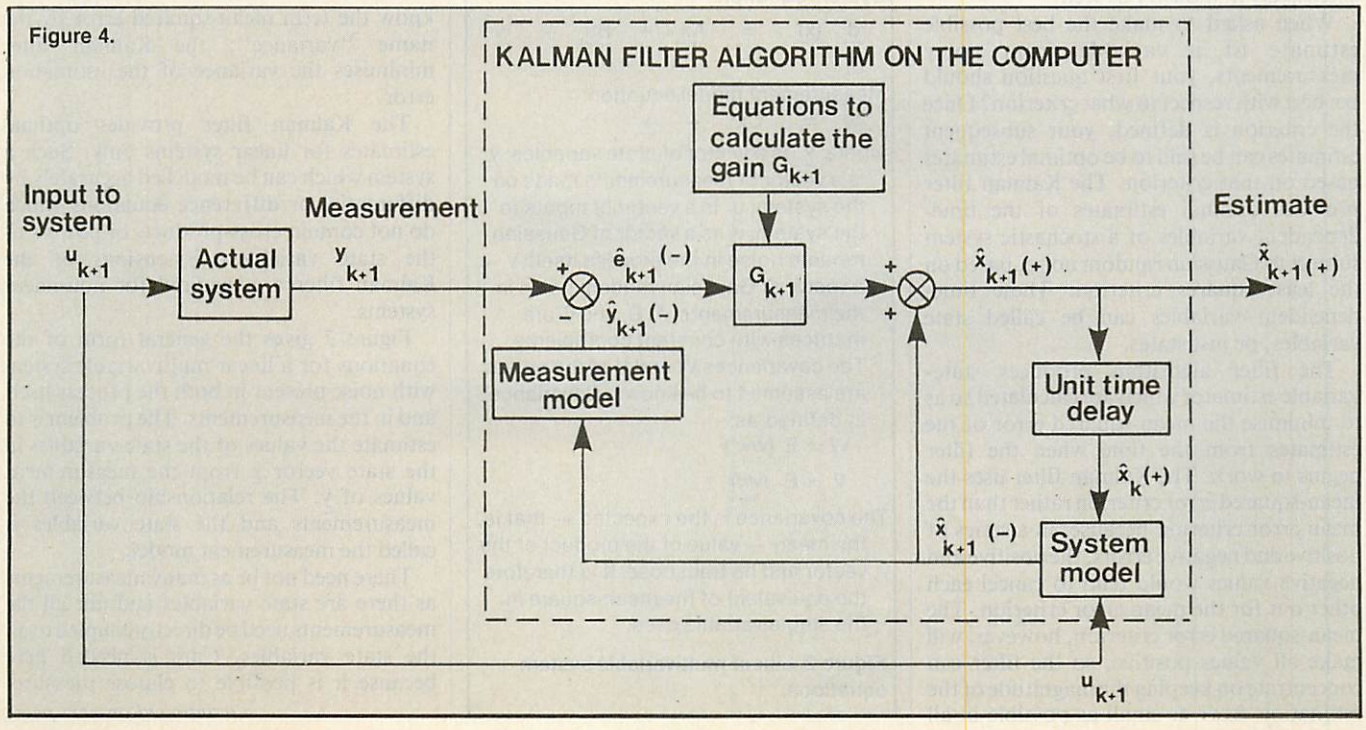
$W = E(w^2)$

$V = E(v^2)$

The variance is the expected — that is, the mean — value of the squared noise.

Figure 3. Linear single-variable system equations.

Figure 4.



Recursive Kalman filters

What do the steel rolling mills, the Space Shuttle and Exocet missiles have in common? Bill Hill explains.

THE KALMAN FILTER is, in essence, a filter for removing noise. It is a recursive algorithm on a digital computer which estimates the values of the variables of a stochastic system from measurements which contain randomly fluctuating noise. In many cases the estimates are needed to control the system. For example, an Exocet missile skimming across the waves contains equipment to measure its height above the surface and keep it at a steady level. With lots of little wavelets superimposed on the ocean swell, together with electrical noise in its circuits, the measurements it receives may look something like the pattern in figure 1. To control the height of the missile it is necessary to estimate the height with the noise filtered. A Kalman filter provides such an estimate, which would look something like the dashed curve shown in figure 1.

A Kalman filter can also be used to estimate variables which are not even directly reflected in the measurements made on the system. For example, a power station's boiler only has a few thermocouples placed in strategic positions. Suppose an engineer needs to know what the steam temperature or pressure is elsewhere, perhaps in some totally inaccessible part of the boiler? Using the few available measurements, a Kalman filter can be used to estimate the otherwise inaccessible variables.

R E Kalman, an American academic, formulated the filter algorithm in the early 1960s. His contribution was to construct a recursive algorithm which decreases the computational burden at each time step, and consequently makes real-time estimation a practical proposition. Previously mathematicians and control engineers had tried to solve the estimation problem using complicated mathematical techniques. Although there are plenty of military uses for Kalman filters they are also used extensively in industry as well.

When asked to make the best possible estimate of a variable from noisy measurements, your first question should be: best with respect to what criterion? Once the criterion is defined, your subsequent estimates can be said to be optimal estimates based on that criterion. The Kalman filter provides optimal estimates of the time-dependent variables of a stochastic system subject to Gaussian random noise, based on the least squares criterion. These time-dependent variables can be called state variables, or just states.

The filter algorithm produces state-variable estimates which are calculated so as to minimise the mean-squared error of the estimates from the time when the filter begins to work. The Kalman filter uses the mean-squared error criterion rather than the mean error criterion because, in a series of positive and negative errors, the positive and negative values would tend to cancel each other out for the mean error criterion. The mean-squared error criterion, however, will make all values positive, so the filter can concentrate on keeping the magnitude of the estimation error as small as possible in all cases. Those familiar with statistics will know the term mean-squared error by the name "variance"; the Kalman filter minimises the variance of the estimation error.

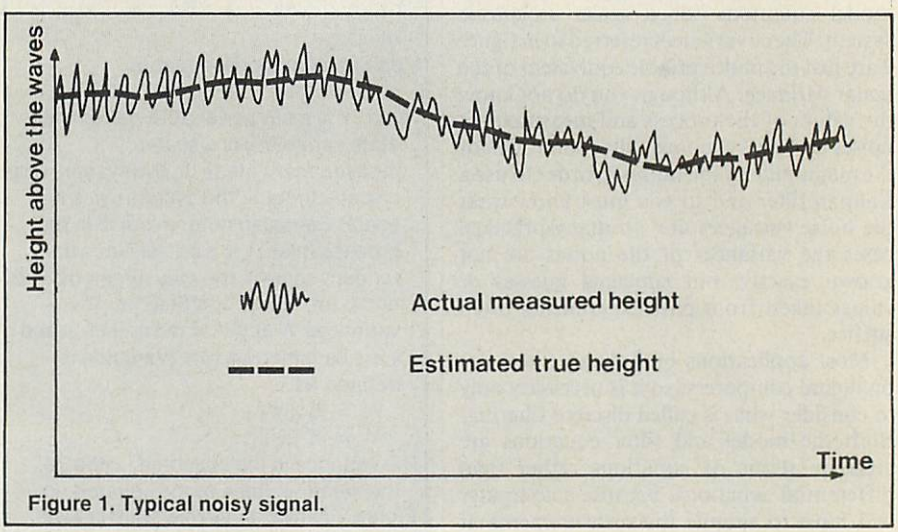


Figure 1. Typical noisy signal.

System equation:

$$\frac{d}{dt}(\underline{x}) = A\underline{x} + B\underline{u} + \underline{w}$$

Measurement model equation:

$$\underline{y} = C\underline{x} + \underline{v}$$

where: $\underline{x}$ is a vector of state variables; $\underline{y}$ is a vector of measurements made on the system; $\underline{u}$ is a vector of inputs to the system; $\underline{w}$ is a vector of Gaussian random noise in the process itself; $\underline{v}$ is a vector of Gaussian random noise in the measurements; A, B, and C are matrices with constant coefficients. The covariances W and V of the noises are assumed to be known. Covariance is defined as:

$$W = E(\underline{w}\underline{w}')$$

$$V = E(\underline{v}\underline{v}')$$

The covariance is the expected — that is, the mean — value of the product of the vector and its transpose. It is therefore the equivalent of the mean-square in the single-variable case.

Figure 2. Linear multivariable system equations.

The Kalman filter provides optimal estimates for linear systems only. Such a system which can be modelled accurately by differential or difference equations which do not contain cross-products or powers of the state variables. Extensions of the Kalman filter are required for non-linear systems.

Figure 2 gives the general form of the equations for a linear multivariable system with noise present in both the process itself and in the measurements. The problem is to estimate the values of the state variables in the state vector $\underline{x}$ from the measurement values of $\underline{y}$. The relationship between the measurements and the state variables is called the measurement model.

There need not be as many measurements as there are state variables and not all the measurements need be directly coupled to all the state variables. Care is needed here because it is possible to choose measure-

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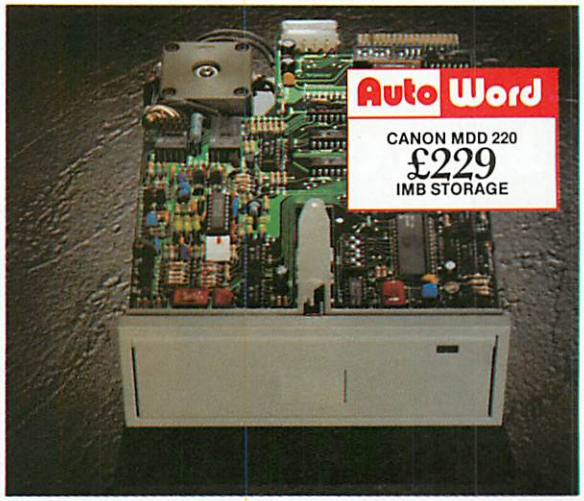

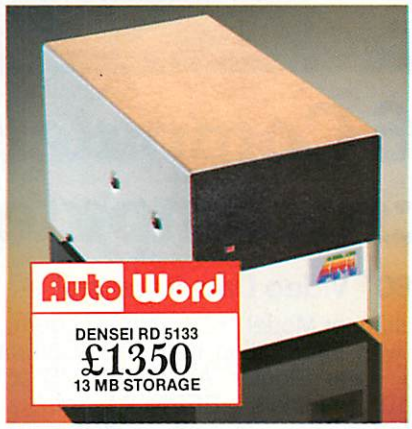

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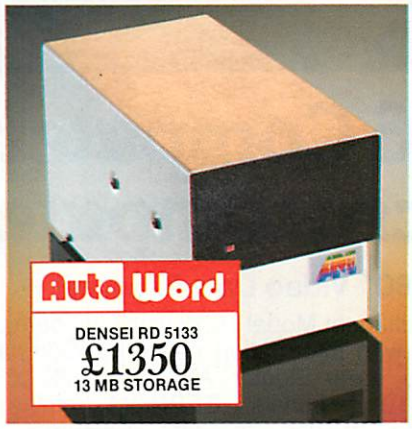

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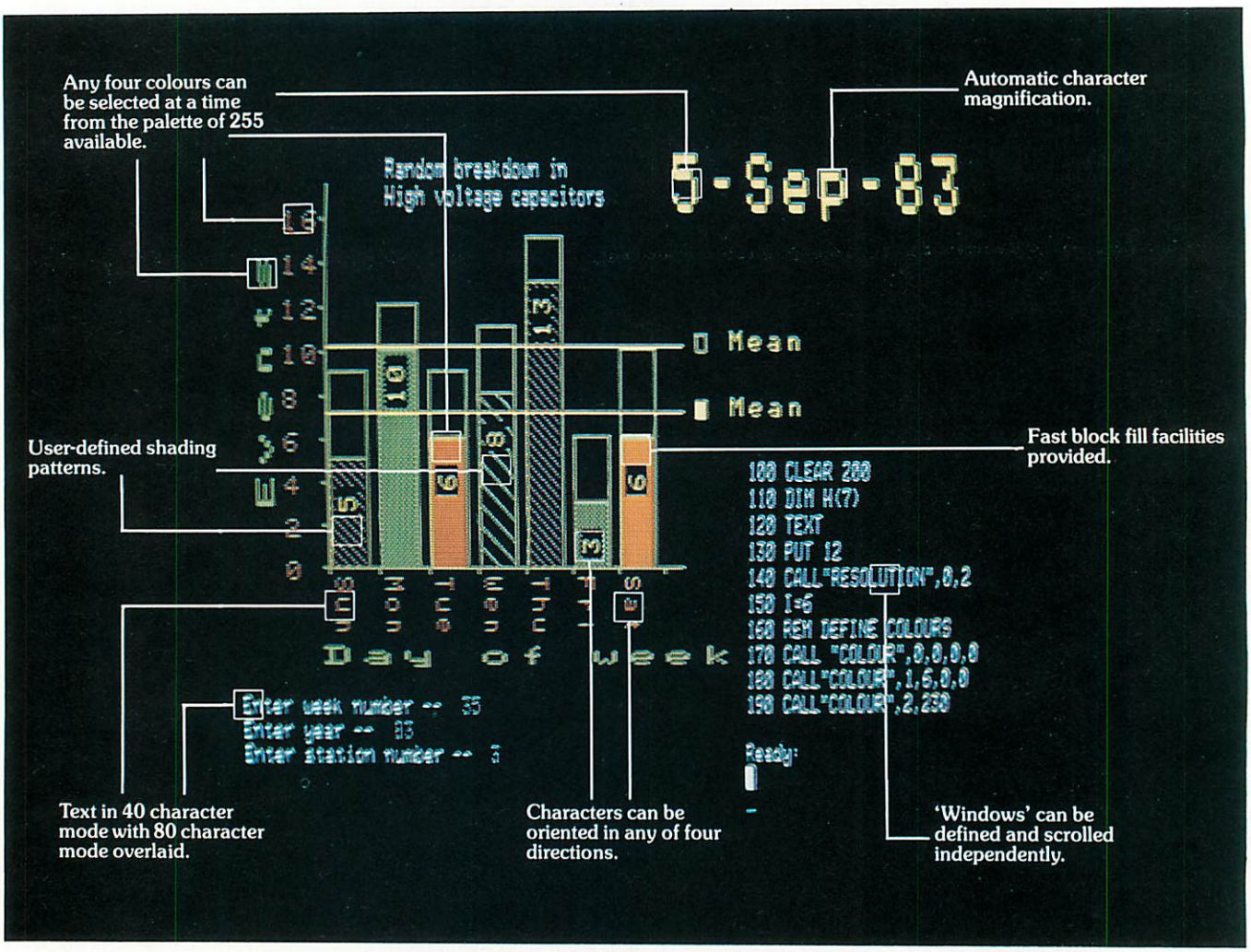
Any four colours can be selected at a time from the palette of 255 available.
Automatic character magnification.
Random breakdown in High voltage capacitors
6-Sep-83
0 Mean
Mean
User-defined shading patterns.
Fast block fill facilities provided.
100 CLEAR 200
110 DIM H(7)
120 TEXT
130 PUT 12
140 CALL"RESOLUTION",0,2
150 I=6
160 REM DEFINE COLOURS
170 CALL "COLOUR",0,0,0,0
180 CALL"COLOUR",1,6,0,0
190 CALL"COLOUR",2,230
Ready
Day of week
Enter week number -- 35
Enter year -- 83
Enter station number -- 3
Text in 40 character mode with 80 character mode overlaid.
Characters can be oriented in any of four directions.
'Windows' can be defined and scrolled independently.

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A picture may be worth a thousand words but it still tells only half the story about graphics on the 380Z.

For a start, our standard graphics functions include point plotting, line drawing, instant block fill, block copying, offsetting, and Exclusive Or Plotting.

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It is also worth noting that 380Z graphics are equally effective in monochrome — for 'colour' just read 'shades of grey'. Again there are 255 shades available, and there's also a very useful facility for fading up and down throughout the grey scale.

There are also the special effects — such as moving between graphics 'pages' for pseudo-animation, or the ability to produce 'instant' graphics by drawing them with the colour 'switched' off and then 'switching' on.

Next, not only can 380Z graphics pictures be saved on and retrieved from disc, they can also be output to one of a range of popular dot matrix printers.

Remember, too, that HRG is not a third-party add-on but designed, developed, and supported by Research Machines itself as an integral part of the 380Z.

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(continued from page 152)

letters, are being used, each letter corresponding to an attribute, and the number required it asks you to assign a weighting from 1 to 100 for each letter. The higher the weighting, the greater the likelihood of the letter being chosen.

The program is self-explanatory, although there are three subroutines at the end, which may be worth noting as they could be useful in your own programs. Lines 8000 to 8010 simply wait for any key to be pressed, although it is a rather over-complex way of doing things.

The Poke 158,0 clears any spurious characters from the keyboard buffer, in case you may have pressed a key before the program is ready, and the Wait 158,1 simply waits for a key to be pressed. The Poke 216,25 forces the next Print statement to be placed on the bottom line of the screen. Lines 8500 to 8540 form a routine which simply flashes a question mark on the screen while waiting for any character, except Return, to be pressed and exits the routine with Z$ holding the character.

The Return CHR$(13) is detected in line 8530 using the ASC function. The Z$ + "" in the brackets is used to avoid an Illegal Quantity error if Z$ does not contain anything. The routine at lines 9000 to 9070 flashes its own cursor and acts like an Input statement, except that cursor movements other than Delete are not allowed, and Z$ contains the typed characters when Return is pressed.

It is a very useful bomb-proof replacement for Input and could be used on a Pet or Vic, provided that the Poke 158,0 in line 9000 is either omitted or changed. If you want to use the program on any Pet other than Basic 2, 3 or 4 Pets, then the Pokes and Wait will have to be changed as in the table. Unfortunately, the program does not write a tie-break slogan for you.

Hardware

Normally Open File covers software and not hardware, but here are some comments from P A Ramsdale of Swindon which may help those who wish to feed the vision signal from one of the new 12in. screen Pets to a monitor.

The user port provides a video, pin 2; vertical sync, pin 9; and horizontal sync, pin 10. They can be combined to produce a composite video signal suitable for a monitor. For old 8in. screen Pets, there are various circuits available to do the combination, but with the new 12in. Pets the signals have been inverted and the line timings have been changed. The line timing, which is about 100ms. rather than the standard 64ms., means that normal monitors will not lock. Fortunately these Pets use a programmable video controller MC-6845, and it is possible to reduce the line time sufficiently for the monitor to synchronise by:

POKE 59520,0 : POKE 59521,X

where X = 62 for 80 columns and X = 59 for 40 columns.

It is also necessary to move the line-sync pulse position so that the lines start at the left-hand side of the screen:

POKE 59520,2 : POKE 59521,Y

where Y = 47 for 80 columns and Y = 49 for 40 columns. The reduction in line timing results in a squeezing of characters on the Pet's screen, but they will appear normally on the monitor. It is also possible that some adjustment of the line-sync pulse width may be needed using:

POKE 59520,3 : POKE 59521,Z

Z starts off at 15 and the pulse can be adjusted by increasing this value.

Whenever the screen mode is altered for instance using Print CHR$(142), all the values in the video controller are reset, and so these Pokes are required whenever it is done. The video combining unit used with the 8in. Pets requires inversion of the video and horizontal signals. The user-port signals could be applied directly to the inputs of a 4066 quad analogue switch to produce a suitable video output.

Skilled judgement table.

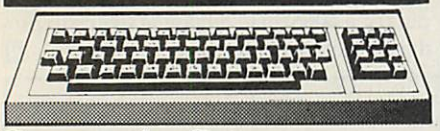
Basic 2/3/4	Basic 1	Vic
POKE 158,0	POKE 525,0	POKE 198,0
WAIT 158,1	WAIT 525,1	WAIT 198,1
POKE 216,25	POKE 245,25	POKE 214,22

Skilled judgement.

```
10 REM** AWARD EACH LETTER A WEIGHTING FROM
20 REM** 1-100 AND THE COMPUTER WILL
30 REM** CHOOSE AN ORDERING OF THE LETTERS
40 REM** BASED ON THE WEIGHTINGS ASSIGNED,
50 REM** BUT WITH A RANDOM FACTOR.
80
100 PRINT"■■■■■■■■■■■■■■MULTIPLE CHOICE■"
110 PRINTSPC(10);"■COMPETITION ENTERER■"
120 PRINT"■■HOW MANY LETTERS TO CHOOSE FROM? ";:GOSUB9000:X=VAL(Z$):PRINT
130 PRINT"■HOW MANY LETTERS SHALL I CHOOSE? ";:GOSUB9000:N=VAL(Z$):PRINT
140 DIMA$(X),A(X),C(X),B(X)
150 PRINT"■■ENTER THE LETTERS ONE AT A TIME, EACH"
160 PRINT"■FOLLOWED BY IT'S RELATIVE WEIGHTING"
165 PRINT"■ON A SCALE 1-100 INCLUSIVE."
170 GOSUB8000
180 PRINT"■■LETTER";SPC(5);"WEIGHTING■":PRINT"──────";SPC(5);"──────────"
190 FORI=1TOX:PRINT"   ";:GOSUB9000:A$(I)=Z$:PRINTSPC(10);
200 GOSUB9000:A(I)=VAL(Z$):PRINT:NEXTI
220 GOSUB7500:GOSUB8000
230 GOSUB7000
250 PRINT"■■■WHICH COMBINATION NUMBER WOULD YOU LIKE "
252 PRINT"TO CHANGE? - (HIT 'RETURN' IF NONE) ";
255 GOSUB9000:PRINT
260 IFZ$=""GOTO300
265 C=VAL(Z$)
270 PRINT"CHANGE ";A$(C);" TO ";:GOSUB9000:A$(C)=LEFT$(Z$,1)
280 PRINT" AND ";A(C);" TO ";:GOSUB9000:A(C)=VAL(Z$):GOSUB7500: GOSUB7000
290 GOTO250
300 GOSUB7500
310 PRINT"■■■"
350 FORI=1TOX:C(I)=I:NEXTI
360 FOR I=1TOX:B(I)=A(I)*RND(1):NEXTI
400 FORI=1TOX-1:FORJ=1TOX-1
410 IFB(J)>=B(J+1)GOTO430
420 T=B(J):B(J)=B(J+1):B(J+1)=T:T=C(J):C(J)=C(J+1):C(J+1)=T
430 NEXTJ:NEXTI
450 PRINT"SELECTION:-":PRINT"──────■
500 FORI=1TON:PRINTA$(C(I));" ";:NEXTI
550 PRINT:PRINT"■■■PRESS■  FOR ANOTHER SELECTION."
560 PRINT"■R■■  TO DISPLAY TABLE AND/OR
570 PRINT"   CHANGE WEIGHTINGS.
580 PRINT"■E■■  TO END.":PRINT"■
600 GOSUB8500:PRINTZ$;
620 IFZ$="D"GOTO230
630 IFZ$="E"THENPRINT"■":END
635 GOTO310
640 PRINT"■■";:GOTO600
6999
7000 PRINT"■";:PRINT"■LETTER";SPC(5);"WEIGHTING■"
7005 PRINT"──────";SPC(5);"──────────":PRINT
7010 FORI=1TOX:IFI<10THENPRINTI;:GOTO7015
7012 PRINT"■■";I;
7015 PRINT" ";A$(I);SPC(10);A(I):NEXT
7020 RETURN
7500 FORI=1TOX-1:FORJ=1TOX-1:IFA(J)>=A(J+1)GOTO7530
7510 T=A(J+1):A(J+1)=A(J):A(J)=T
7520 T$=A$(J+1):A$(J+1)=A$(J):A$(J)=T$
7530 NEXT:NEXT:RETURN
7999
8000 PRINT"■":POKE158,0:POKE216,25:PRINTTAB(7)"■■PRESS ANY KEY TO CONTINUE■"
8010 WAIT158,1:GETZ$:RETURN
8500 POKE158,0:ZC=1
8510 T=TI
8520 IFTI-T>20THENPRINTMID$("? ",ZC,1)"■";:ZC=3-ZC:GOTO8510
8530 GETZ$:IFZ$=""ORASC(Z$+" ")=13GOTO8520
8540 RETURN
8999
9000 POKE158,0:ZC=1:Z$="":ZL=0
9010 T=TI
9020 IFTI-T>20THENPRINTMID$("■ ",ZC,1)"■";:ZC=3-ZC:GOTO9010
9030 GETZZ$:IFZZ$=""GOTO9020
9040 ZA=ASC(ZZ$):IFZA=13THENPRINT" ";:RETURN
9045 IFZA=20ANDZL>0THENPRINTZZ$;:ZL=ZL-1:Z$=LEFT$(Z$,ZL):GOTO9020
9050 IFZA>140ANDZA<158GOTO9020
9060 IFZA>13ANDZA<31GOTO9020
9065 IFZL>254GOTO9020
9070 ZL=ZL+1:Z$=Z$+ZZ$:PRINTZZ$;:GOTO9020
```

TANDY FORUM

by John Wellsman



Commas for Gotos

In the January issue, I described how it is, under some circumstances, possible to use a comma instead of Goto and Then. P V Bamfield of Brighton has written to point out that while this does work, if you use a utility program to renumber the program you are likely to run into difficulties.

Mr Bamfield says that with two renumbering utilities he had error messages. I tried this myself with the Newdos and Ldos routines, and though I got no error messages and superficially correct renumbering I found that the lines numbers after the commas had not been changed. My apologies for not having checked this earlier.

Race 2000

R S Powell of Coventry sent in a game program which he calls Race 2000. Instructions for the game, which is a racing-car obstacle course rather than a race, are included in the listing, which is in Tandy level 2 Basic. It also includes a machine-language sound routine in the last eight lines.

The machine code is string-packed, avoiding the necessity of reserving any memory. The Put (X,Y) commands in the listing call the sound routine to produce a variety of engine noises. To hear them you have to plug in your cassette lead and connect the large grey jack to an amplifier. The £ signs between quotes represent spaces wherever they occur — except in line 1080, which tells you that the car is represented by a shifted 3 CHR$(35).

Basic insert

This routine was sent in by Mark Emery of Orpington, Kent. It enables you to insert a line of Basic into a program while it is still running, and without losing any variables except those used by the routine. Although the inserted line in this program is the last line of the program, it can be anywhere, and be defined as the variable Lin with a separate input.

The listing is for level 2 or DOS 48K machine. For a 16K machine two addresses in line 40 must be changed: —8192 becomes 29952, and —12288 becomes 28672. Line 45 should be changed to

DATA 33,0,112,205,192,27,201,0,0,0".

This program is not unlike Andrew Parsonage's program in last month's Tandy Forum. If you are interested to know how the computer handles Basic, a close study of this sort of program is both helpful and interesting.

On Run the first thing that a computer must know is the location in memory of the program. The start address of any Basic program is stored in addresses 16548/9, the least-significant byte being stored first and most-significant last. These two addresses are in an area of RAM which is reserved for housekeeping items like this. So the expression

PEEK(16548) + PEEK(16549)*256

will give the starting address of a resident Basic program. By Peeking at and above this address it is possible to see how the computer stores a Basic program.

Type in the test program exactly as shown without any spaces in the first three lines. If you do not have a printer, for line 130, substitute

PRINT PEEK(P + Y);

and read from the screen.

Make sure that the printer is on line and loaded and then Run. The output is a column of figures followed by a line of dots on which you can write notes. Write on the top line the figure given by line 105 in the

(continued on page 160)

Race 2000.

```
1 CLEAR 100:DEFINTA-Z:GOSUB
1000:GOTO 3000:
5 GOTO 100
20 FOR I=0 TO 18 STEP 2
30 SET(X+I,Y):NEXT:RETURN
50 FOR I=8 TO 26:RESET
(I,25):NEXT:RETURN
80 GOTO 5
100 CLS
110 PRINT@66,"*R A C E   P R A C T
I C E *";
120 PRINT@130,"=======* 2 0 0 0
*=======";
130 PRINT@258,"* S P E E D *£££* C
O U N T *";
140 PRINT@450,"* T E M P . *£££££*
O I L *";
150
PRINT@514,"L";:PRINT@526,"H£££E";:P
RINT@542,"F";
160 PRINT@642,"D I S T A N C E :";
170 PRINT@116,"F U E L :";
180 PRINT@504,"P I
T";:PRINT@568,"S T O
P";:PRINT@632,"A R E A";
190 PRINT@952,"*START*";
200 FOR Y=0 TO
47:SET(0,Y):SET(1,Y)
210 SET(64,Y):SET(65,Y):SET(127,Y)
220 NEXT
230 FOR X=0 TO 64
240 SET(X,47):SET(X,10):SET(X,34)
250 SET(X,19):SET(X,28):SET(X,0)
260 NEXT:FOR Y=10 TO 27:FOR X= 1
TO 2:
270 SET(31+X,Y):NEXT X,Y
280 FOR X= 110 TO 127:SET(X,47)
290
SET(X,17):SET(X,35):SET(X,40):SET(X
,0)
300 NEXT:FOR X=100 TO
110:SET(X,47)
310 SET(X,10):SET(X,0):NEXT
320 FOR Y=0 TO 10:
SET(100,Y):SET(101,Y):NEXT
330 FOR Y=10 TO 47:
SET(109,Y):SET(110,Y):NEXT
340 FOR Y=42 TO
47:SET(100,Y):SET(101,Y):NEXT
350 FOR Y=21 TO 32: SET
(100,Y):SET(101,Y):NEXT
360 X=8:Y=26:GOSUB 20
370 X=39:GOSUB 20
380 X=104:Y=8:GOSUB 20
385 REM ------------INITIAL
SETTING AT LINE 390-----------
390
A=50:F=122:C=0:D=0:T=7:O=57:V=16244
:M=64:B=0
400 FOR X=39 TO
57:SET(X,25):SET(X+65,7):NEXT
410
PUT(200,255):PRINT@824,"(READY)";:P
OKEV,35:FOR I=1 TO 500:NEXT
420
PUT(100,175):PRINT@824,"-*SET*-";:F
```

(listing continued on page 160)

C/WP BITES £200 OFF APPLE II E

Meet the Apple II E, the brand new much improved version of the tried and trusty Apple II. The "E" has (almost) everything you ever wished the Apple had. The memory has been increased to 64k with an optional expansion to 128k. The keyboard has sprouted extra keys, making 63 in all, with proper shift keys and four arrow keys to drive the cursor round the screen. The screen boasts capitals and lower case letters (40 to a line—or 80 with a low cost optional add-on). And for brilliant colour the "E" has a built-in PAL encoder—just add a modulator and it plugs straight into your colour television set.

The 80 column card is only £70 (no, it won't work with the Apple II Europlus). For £150, you can buy another card which provides both 80 columns and an extra 64k of memory which switches in and out as required.

Apple II has joined the big league.

But there's one thing Apple Computer has not changed. The "E" still runs all (or almost all) Apple II's enormous library of software without reprogramming or adaption. And you can still use the disc drives and expansion cards from the Europlus except for the 16K RAM card which you no longer need).

Alas, the "E" costs more than its predecessor. But C/WP has had its way and is cutting £200 off the recommended retail price. The "E" is yours for a modest £645 plus VAT.

Prices do not include VAT.		RRP	C/WP Price
Apple II E		£845	£645
80 column card		£80	£70
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● Circle No. 161

(continued from page 158)

program. The actual addresses will vary according to your system and memory size though their relationship will be the same, so I will give the values from my own machine.

My program starts at 27206 and the first two numbers are 83 and 106; the third and fourth are 10 and 0 — and will be the same in your printout if you have copied the program exactly. The first two are the least- and most-significant bytes of the address of the next line, line 20, of the program. In this case it is 83 + 256*106 = 27219. The second pair are the least- and most-significant bytes of the program line number.

These two pairs of numbers are followed by the text of the program line. The command words such as For, Next, and so on are not stored as words but as tokens or single bytes, and in the example the first number following the line pair 10,0 is 129, which is the token for For. It is followed by 88, the ASCII code for X and then 213, which is the token for the function of equality — not to be confused with the character =. Then 49, ASCII 1; 189, the token for To; followed by 49,48,48, for 1,0,0. Finally there is an end-of-line indicator, 0.

(continued on page 162)

(listing continued from page 158)

```
OR I=1 TO 500:NEXT
430 PUT(50,75):PRINT@824,"*-GO-*";
435 REM ----------MAIN PROGRAM
STARTS HERE ---------
440 IF A=<0 THEN
A=0:PRINT@327,"100";:GOTO 460
450
S=(52-A)*2:PRINT@327,STR$(S);"£";
455 S=50/A
460 C=C+1:PRINT@343,STR$(C);:IF A
<50 THEN A=A+B ELSE IF B =-5 THEN
A=A+B
470 POKEV+M,32:POKEV,35:I=0
480 I=I+1
481 IF S=0 THEN PUT(1,1) ELSE
PUT(S,1)
490 PRINTCHR$(15);:K$=INKEY$:IF
K$<>"" THEN 590
500 IF I<A THEN 480
510 V=V-M: IF V<15360 THEN POKE
V+M,32:V=V+1088:GOTO 810
520 IF PEEK(V) <> 32 THEN 940
530 IF RND(3)>1 THEN 440
540 IF RND(2)>1 THEN 570
550 X=RND(15)+32:Y=RND(15)*64
560 FOR I=0 TO
RND(2):PRINT@Y+X+I,"+";:PUT(10,5):N
EXT:GOTO 440
570 Y=RND(15)*64:FOR I=33 TO
48:PRINT@Y+I,"£";:NEXT
580 GOTO 440
590 IF K$="8" THEN M=64:GOTO 440
600 IF K$="7" THEN M=65:GOTO 440
610 IF K$="9" THEN M=63:GOTO 440
620 IF K$="5" THEN B=-5: GOTO 440
630 IF K$="2" THEN B=0:GOTO 440
640 IF K$="." THEN B=10:GOTO 440
650 IF K$="1" THEN IF INKEY$=""
THEN 650 ELSE 440
660 IF K$<>CHR$(13) THEN 500
670 X=V-15360:Y=X/64:X=X-(Y*64)
680 IF X<52 OR X>54 THEN 500
690 IF Y< 6 OR Y>11 THEN 500
700 PRINT@770," * R E - F U E L I
N G *";
710 IF F<122 THEN F=F+1:SET (F,7)
715 PUT ((130-F)*8,20)
720 IF O=57 THEN IF F=122 THEN 770
ELSE 470
730 O=O+1:SET(O,25)
740 T=T-RND(T-7):A=50:GOSUB 50: IF
T<7 THEN T=7
745 FOR I= 7 TO T:SET(I,25):NEXT
749 I=0
750 I=I+1
752 IF INKEY$=CHR$(13) THEN 790
755 IF I>O THEN 710
765 'PUT(255,255)
770 PRINT@770," * T A N K S  F U L
L *";
772 PRINT@835,": PRESS ENTER TO
CONT. *";
780 PRINT@312,"£FULL££";:IF
INKEY$<>CHR$(13) THEN 780
790 PRINT@770,"
   ";' (-- 24 spaces
791 PRINT@834,"
   ";' (-- 24 spaces
800 PRINT@312,"£££££";
810 N=S/100:I=-1
820 I=I+1:IF I>N THEN 850
830 RESET(F,7): IF F> 103 THEN
F=F-1:GOTO 820
840 PRINT@312,"*EMPTY*";:GOTO 960
850 IF F<110 THEN
PRINT@312,"RE-FUEL";:'PUT(10,10)
860 D=D+1:PRINT@660,STR$(D);:C=C+1
870 IF (D+1)/2=INT((D+1)/2) THEN
RESET (O,25):O=O-1
880 IF O=38 THEN PRINT@770," O I L
 E M P T Y";:PUT(2,20):GOTO 960
885 'PUT (2,20)
905 IF RND(5)>1 THEN 930
910 SET( T,25):T=T+1
920 IF T>19 THEN PRINT@770," O V E
R  H E A T I N G
";:PUT(30,70):GOTO960
925 'PUT(30,70)
930 GOTO 440
940
PRINT@V-15360,"BANG";:PUT(10,87):PU
T(46,63):PUT(65,01):PUT(99,28):PUT(
34,25):PUT(34,25)
950 PRINT@770, "YOU HAVE HIT AN
OBSTACLE...!";
960 PRINT@898,"PRESS < ENTER > FOR
A NEW GAME. ";
970 PRINT@834,"Y O U  H A V E  L O
S T !";
975 K$=INKEY$
980 K$=INKEY$:IF K$="" THEN 980
990 IF K$=CHR$(13) THEN 5 ELSE END
1000 CLS
1010 PRINTTAB(12)"WELCOME TO RACE
PRACTICE 2000"
1015
PRINTTAB(12)"=====================
=======
1020 PRINT
1030 PRINT"YOU HAVE TO COMPLETE AS
MANY LAPS AS POSSIBLE!"
1040 PRINT"BUT WATCH OUT FOR THOSE
OBSTACLES - THEY CAN POP ANYWHERE"
1050 PRINT"ALONG THE ROAD!"
```

(listing continued on page 162)

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(continued from page 160)

From the first number to the end of line, there are 13 numbers. Using my starting address, 13 + 27206 equals 27,219 which is the 14th line and brings you to the start of the second line where again you find two pairs of numbers, the first two being the LSB and MSB of the beginning of the third line, and the second pair being the LSB and MSB of the current line number.

In line 120 of the test program above I have only Peeked into the first 29 addresses, covering the first three program lines. You could increase this number and look at the rest of the program which does the Poking and Peeking.

If you do not have a table of command tokens it should be quite easy to construct one by writing dummy programs using all the commands, reading them out as described and then decoding the listing.

May I enter a plea to those who send in programs. Please, never, ever use I or O for subscripting variables. Many people use I especially in this way, but A(I) and A(1) can be so easily confused when typing in programs, so please use something else. O is just as bad, though is used less often. There are 24 other characters which can cause no confusion.

(listing continued from page 160)

```
1060 PRINT"ALL THE INFORMATION
REQUIRED IS DISPLAYED, SO BE
OBSERVANT."
1066 PRINT"THE INFORMATION
INCLUDES:"
1067
PRINT"SPEED":PRINT"COUNT":PRINT"DIS
TANCE":PRINT"TEMPERATURE":PRINT"FUE
L":PRINT"OIL":
1070 GOSUB 1180:CLS:PRINT
1075 PRINTTAB(10)"THE CONTROLS ARE
AS FOLLOWS :"
1080 PRINT"'&'.....IS THE CAR"
1090 PRINT"'7'.....GO LEFT"
1100 PRINT"'9'.....GO RIGHT"
1110 PRINT"'8'.....GO UP"
1120 PRINT"'5'.....TO ACCELERATE"
1130 PRINT"'.'.....TO DECELERATE"
1140 PRINT"'2'.....TO KEEP SPEED
CONSTANT"
1150 PRINT"'1'.....TO FREEZE"
1160 PRINT"'0'.....TO CONTINUE"
1170 PRINT"'ENTER'.TO
RE-FUEL/CONTINUE
1175 PRINT:PRINT:PRINT"THE GAME
START WITH 'READY' - 'SET' -
'GO!'"
1176 GOTO 1192
1180 '
1190 PRINTTAB(15)"PRESS ANY KEY TO
CONTINUE"
1191 GOTO 1200
1192 GOSUB 1180::CLS:PRINT"ONE
LAST NOTE:- SOUND FOR THIS PROGRAM
IS PLAYED THROUGH THE CASSETTE
PORT AND MAY BE OBTAINED BY PUTING
SOME SORT OF AMPLIFIER ON";
1193 PRINT" THE CASSETTE
OUTPUT.":PRINT:PRINT:PRINTTAB(15)"-
---** PRESS ANY KEY TO START
**----"
1200 IF INKEY$="" THEN 1200 ELSE
RETURN
2999 REM ==MACHINE CODE ROUTINE
LOADER==
3000 CLS:MX$=".....MACHINE CODE
ROUTINE STORED IN THIS
VARIABLE....."
3020
C=VARPTR(MX$)+1:LO=PEEK(C):HI=PEEK(
C+1):POKE 16771,LO:POKE16772,HI
3030 LO=256*HI+LO
3040 FOR I=LO TO
LO+41:READA:POKEI,A:NEXT:GOTO 3080
3050
DATA197,207,40,205,28,43,71,197,207
,44,205,28,43,193,79
3060
DATA197,207,41,193,197,193,197,62,1
,211,255,16,254,193,197
3070
DATA62,2,211,255,16,254,193,13,32,2
35,193,201
3080 GOTO 5
60000 GOTO 60000
60023 SAVE"RACEPOWE/002:1
```

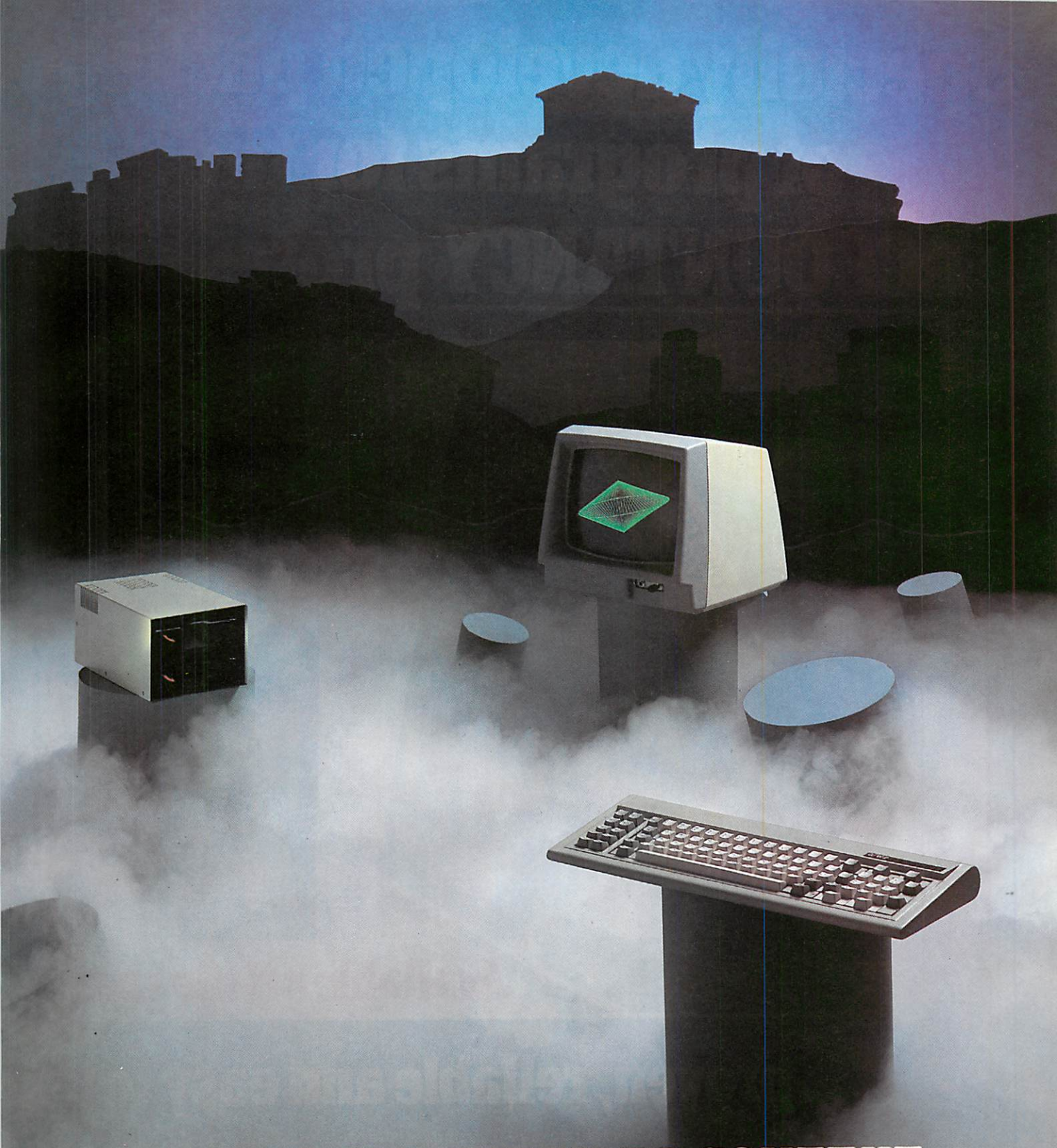
Basic insert listing 1.

```
 1 CLS:CLEAR 5000
 2 LIN=9999
 5 GOSUB 150:REM FIND BEGINNING OF
   LINE LN
 10 PRINT"ENTER THE LINE TO BE
PLACED AT";LIN
 20 LINEINPUT")";F$
 25 F$=F$+":REM "
 30 FOR T=1 TO  LEN(F$):
M$=MID$(F$,T,1):
POKE-12288+T,ASC(M$):NEXT
 40 DEFUSR1=-8192:FOR T = 0 TO
  7:READ D:POKE-8192+T,D: NEXT
 45 DATA 33,0,208,205,192,27,201,
  0,0,0
 50 A=USR1(0):X=16551
 60 X2=PEEK(X)+PEEK(X+1)*256
 70 FOR T=0 TO 255
 80 IF PEEK(T+X2)=0 THEN 120
 90 POKE RL+T,PEEK(T+X2-1)
 100 NEXT
 120 PRINT"DONE":LIST 9999
 150 ST=PEEK(16548)+PEEK(16549)*256
 170 A1=PEEK(ST):A2=PEEK(ST+1):
A3=A1+A2*256
 180 SU=PEEK(ST+2)+PEEK(ST+3)*256:
    IF SU()LIN THEN ST=A3:GOTO 170
 190 RL=ST+4
 200 RETURN
 9999 ..............................
 ..................................
 ..................................
 ..................................
 ..................................
 ................
```

Basic insert listing 2.

```
10 FORX=1TO100
20 Z=X+2
30 NEXT
100 P=PEEK(16548)+PEEK(16549)*256
105  LPRINT"PROGRAM STARTS  AT";P;"
IN RAM":
120 FOR Y=0 TO 28
130                              LPRINT
PEEK(P+Y);".............":
140 NEXT
```


● Circle No. 186 ▶



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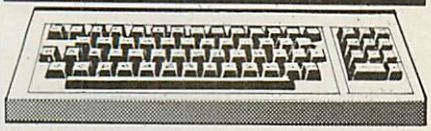
BBC BYTES

by John Harris



Space Invaders

The Space Invaders program by P Mclean in the BBC Bytes column on page 141 of the February issue contains a keying error on line 400, which should read

400 FOR Q = 1 TO NI

The program runs as far as screen 6 before blowing up with the subscript error because the variable I, which I mistakenly substituted for NI when keying in the listing, can never exceed NI + 1; the For statement on line 100 keep it within this limit. NI, the number of invaders, reaches 7 on screen 6 giving a maximum value of I of 8, which exceeds the maximum dimensions for X%( ) and Y%( ) for the first time.

Normally we not only proof read BBC Bytes programs back to the original hard-copy version submitted by contributors, but also test the program through all visible pathways before publishing. Because I couldn't react fast enough to get past screen 2, I never met the bug which has given more expert players such a frustrating time.

When testing a tax or stock-control program there is a logical pathway to be followed; testing games requires that the tester is capable of playing the game to a satisfactory standard. Apologies all round, and thanks to the many readers who wrote in to point out the bug.

Graph

We have been sent two graph-plotting programs and fittingly, since graph plotting is an academic pursuit, the two contributors both have an academic background. Ann Kitchen of Stockport Grammar school comes from the teaching side, and A P Walker of Hayling Island, Hampshire from the taught.

Mrs Kitchen has written her program around the capabilities of the Tandy four-colour pen graphic printer. The printer sells for under £150, so true graph plotting is now affordable within school budgets. The program is designed to handle either cartesian or parametric equations, the Eval facility enabling both limits and equations to be entered while the program is running. The exercise remains under the control of the program operator from start to finish.

Both equation and limits are input and

(continued on next page)

Graph 1 by A P Walker.

```
>REM /////////// THIS IS THE
>REM LISTING FOR GRAPH (1)
>REM BY A.P.WALKER
>LOAD"A.APW2"
>LIST
   10 MODE7
   20 PROCINTRO
   30 MODE1
   40 PROCINTRO2
   50 ON ERROR GOTO1190
   60 DIMA$(15):XBOT=-20:XTOP=20:YBO
T=-20:YTOP=20:@%=&100030A:A=0
   70 *KEY 10 OLD|M RUN|M
   80 MODE1
   90 PROCLETTERS
  100 PROC_INPUT:PROCDRAW:GOTO100
  110 DEFPROCDRAW
  120 CLS
  130 REM********** DRAW AXIS ******
****
  140 VDU29,PX;PY;
  150 VDU5
  160 MOVE-PX,0:DRAW1280-PX,0
  170 MOVE0,-PY:DRAW0,1024-PY
  180 REM********** CALCULATE WHERE
NOS. ********************* SHOULD BE
 ************
  190 IF TY=2 THEN T1X=0:TESTX0=1E-1
0
  200 IF TX=2 THEN T1Y=0:TESTY0=1E-1
0
  210 IF TY=2 AND TX=2 THEN TESTX0=0
  220 IF TY=1 THEN T1X=1012-PY:TESTX
0=0
  230 IF TX=1 THEN T1Y=1140-PX:TESTY
0=0
  240 IF TY=1 AND TX=1 THEN TESTX0=X
TOP
  250 IF TX=0 THEN T1Y=140-PX:TESTY0
=0
  260 IF TY=0 THEN T1X=-PY:TESTX0=0
  270 IF TY=0 AND TX=0 THEN TESTX0=X
BOT
  280 REM****PUT ON NOS. AND REFEREN
CE LINES**********************
  290 FOR X=XBOT TO XTOP STEP XRANGE
/8
  300 GCOL0,1
  310 IF X<>0 THEN MOVEX/XRANGE*1000
,1000*YTOP/YRANGE
  320 IF X<>0 THEN DRAWX/XRANGE*1000
,1000*YBOT/YRANGE
  330 GCOL0,3
  340 FOR XCOUNT=1TOLEN(STR$(X))
  350 MOVEX/XRANGE*1000,T1X
  360 PLOT0,0,69*SGN(ABS(ABS(SGN(TY-
2))-1))+SGN(ABS(SGN(TY)-1))*(LEN(STR
$(X))+1)*32+SGN(ABS(ABS(SGN(TY-1))-1
))*20-(XCOUNT*30)
  370 IF X<>TESTX0 THEN PRINT;CHR$(1
79+ASC(MID$(STR$(X),XCOUNT,1)))
  380 NEXT:NEXT
  390 FORY=YBOT TO YTOP STEP YRANGE/
8
  400 IF Y<>0 THEN GCOL0,1:MOVE1000*
XBOT/XRANGE,1000*Y/YRANGE
  410 IF Y<>0 THEN DRAW1000*XTOP/XRA
NGE,1000*Y/YRANGE
  420 GCOL0,3
  430 IF TY=1 AND Y=YTOP THEN O=0 EL
SE O=1
  440 IF TY=0 AND Y=YBOT THEN O1=1 E
LSE O1=0
  450 MOVET1Y-LEN(STR$(Y))*35*SGN(AB
S(ABS(SGN(TX-1))-1)),Y/YRANGE*1000+3
0*SGN(ABS(SGN(Y)-1))*O+O1*30
  460 IF Y<>TESTY0 THEN PRINT;Y
  470 NEXT
  480 REM**********DRAW GRAPH
  490 I=0
  500 I=I+1
  510 TEST%=0
  520 GCOL0,2
  530 X=XBOT
  540 DEFPROCGRAPHY
  550 X=X+XRANGE/250
  560 Y=EVAL(A$(I))
  570 X1=X:Y=Y/YRANGE*1000:X1=X/XRAN
GE*1000:IF ABS(Y)<1000*YTOP/YRANGE A
ND Y>1000*YBOT/YRANGE AND TEST%=1 TH
EN DRAW X1,Y ELSE MOVE X1,Y:TEST%=1
  580 IF X<=XTOP THEN GOTO550
  590 GCOL0,3
  600 IF I<A THEN500
  610 WAIT=GET
  620 ENDPROC
  630 DEFPROC_INPUT
  640 REM***************INPUT SECTIO
N
  650 CLS:VDU4
  660 PRINTTAB(10,0);"INPUT SECTION"
  670 PRINTTAB(10,1);"=============
  680 PRINT''"To ENTER an equation j
ust press ""F1"".""To DELETE an equ
ation just press ""F2"".""To DRAW t
he graph just press ""F3"".":IF A>0
 THEN PRINT"The present equations ar
e shown below:-"'
  690 IF A>0 THEN FOR PRI%=1 TO A:PR
INT;PRI%;". Y= "A$(PRI%)':NEXT
  700 IF INKEY(-114)<>0 THEN740 ELSE
 IF INKEY(-115)<>0 AND A>0 THEN710 E
LSE IF INKEY(-116)<>0 THEN750 ELSE 7
00
  710 INPUT "Delete equation number.
..      "nodelete:IF nodelete=0 OR no
delete>A THEN650
  720 FOR I=nodelete TO A:A$(I+1)=A$
(I):NEXT
  730 A=A-1:GOTO750
  740 A=A+1:PRINT:A;:INPUT". Y= "A$(
A)
  750 PRINTTAB(0,4)STRING$(158," ")
  760 INPUTTAB(0,5)"Is this equation
 O.K ",Y$:Y$=LEFT$(Y$,1):IFY$<>"Y" T
HEN650
  770 PRINTTAB(0,7):STRING$(40," ")
  780 PRINTTAB(0,5):"Is the range O.
K :-
 "" X:(";XBOT;" TO ";XTOP;") and Y:
(";YBOT;" TO ";YTOP;")";:INPUT,Y$:Y$
=LEFT$(Y$,1):IFY$="Y" THEN PROCTESTA
XIS:ENDPROC
  790 PRINTTAB(0,5);STRING$(80," ")

  800 INPUTTAB(0,5)"Bottom of 'X' ra
nge",XBOT
  810 INPUT"Top of 'X' range",XTOP
  820 IF XBOT>XTOP THEN TEMP=XTOP:XT
OP=XBOT:XBOT=TEMP
  830 IF FNTEST(XTOP-XBOT)=0 THEN790
  840 PRINTTAB(0,5):STRING$(80," ")
  850 INPUTTAB(0,5)"Bottom of 'Y' ra
nge",YBOT
  860 INPUT"Top of 'Y' range",YTOP
  870 IF YBOT>YTOP THEN TEMP=YTOP:YT
OP=YBOT:YBOT=TEMP
  880 IF FNTEST(YTOP-YBOT)=0 THEN840
  890 GOTO770
  900 DEFPROCTESTAXIS
  910 PX=ABS(XBOT)/(ABS(XBOT)+ABS(XT
OP)):TX=2
  920 IF XBOT>0 THEN PX=-XBOT/(XTOP-
XBOT):TX=0:GOTO940
  930 IF XTOP<=0 THEN PX=ABS(XBOT)/(
ABS(XBOT)+ABS(XTOP)):TX=1:GOTO940
  940 PX=PX*1000+140
  950 PY=ABS(YBOT)/(ABS(YBOT)+ABS(YT
OP)):TY=2
  960 IF YBOT>=0 THEN PY=-YBOT/(YTOP
-YBOT):TY=0:GOTO980
  970 IF YTOP<=0 THEN PY=ABS(YBOT)/(
ABS(YBOT)+ABS(YTOP)):TY=1:GOTO980
  980 PY=PY*1000+12
  990 YRANGE=FNRANGE(TY,YTOP,YBOT)
 1000 XRANGE=FNRANGE(TX,XTOP,XBOT)
 1010 ENDPROC
 1020 DEFFNRANGE(T,ITOP,BOT)
 1030 IFT=2 THEN RANGE=ABS(BOT)+ABS(
ITOP) ELSE IF T=1 THEN RANGE=ABS(BOT
-ITOP) ELSE RANGE=ITOP-BOT
 1040 =RANGE
 1050 DEFFROCLETTERS
 1060 VDU23,224,&00,&08,&08,&08,&08,
&08,&08,&08
 1070 VDU23,225,&00,&00,&00,&C0,&C0,
&00,&00,&00
 1080 VDU23,227,&00,&3E,&7F,&59,&4D,
&7F,&3E,&00
 1090 VDU23,228,&00,&40,&42,&7F,&7F,
&40,&40,&00
 1100 VDU23,229,&00,&42,&63,&71,&59,
&4F,&46,&00
 1110 VDU23,230,&00,&22,&63,&49,&49,
&7F,&36,&00
 1120 VDU23,231,&00,&18,&1C,&16,&7F,
&7F,&10,&00
 1130 VDU23,232,&00,&27,&67,&45,&45,
&7D,&39,&00
 1140 VDU23,233,&00,&3C,&7E,&4B,&49,
&79,&30,&00
 1150 VDU23,234,&00,&01,&71,&79,&0D,
&07,&03,&00
 1160 VDU23,235,&00,&36,&7F,&49,&49,
&7F,&36,&00
 1170 VDU23,236,&00,&06,&4F,&49,&49,
&3F,&1E,&00
 1180 ENDPROC
 1190 DEFFNTEST(DIFF)
 1200 PRINTTAB(0,5)STRING$(80," ")
```

(listing continued on next page)

One line-word processor.

```
>REM /////////// THIS IS THE ONE LINE WORD PROCESSOR MENTIONED IN GRAPH (1)
>WIDTH 36
>LOAD"A.APW1"
>LISTO1
>LIST
   1 DIMA$(100):FORI=1TO100:PRINT;I
;:INPUT LINE A$(I):NEXT:PRINT"TURN O
N PRINTER":INPUT F:FORI=1TO100:PRINT
A$(I):PRINT:NEXT:END
```


● Circle No. 187

(listing continued from previous page)

```
 1210 IF DIFF=0 THENPRINTTAB(0,5);"T
his range is not acceptable.":FORDEL
AYLOOP=1TO5000:NEXT
 1220 =DIFF
 1230 IF ERR=20 OR ERR=18 OR ERR=21
OR ERR=22 OR ERR=23 OR ERR=24 THEN P
ROCGRAPHY:GOTO100 ELSE GOTO100
 1240 DEFPROCINTRO
 1250 VDU23;8202;0;0;0;
 1260 PRINTTAB(15,9);CHR$141"GRAPH":
PRINTTAB(15,10);CHR$141"GRAPH":PRINT
TAB(27,15);"By A.P.Walker":FORI=1TO5
000:NEXT
 1270 ENDPROC
 1280 DEFPROCINTRO2
 1290 VDU23;8202;0;0;0;
 1300 CLS:PRINTTAB(15,0);"GRAPH":PRI
NTTAB(14,1);"========"
 1310 PRINT''"This program takes one
or more equations, and plots their g
raph .The equations  should be ente
red using the following:-""  ""*"" f
or multiplication ."" ""^"" for pow
ers ."" ""/"" for division ."" ""+
"" for addition ."
 1320 PRINT" ""-"" for subtraction .
""and ""("" and "")"" wherever nece
ssary .""''All equations should be e
xpressed in  terms of 'X'"
 1330 PRINT"Multiplication signs can
't be ""assumed"",e.g:-""  '5X'
""should be written as:-""  '5*X
'""''All 'trig' functions are in rad
ians .""''To continue after the grap
hs have been  drawn ,just press any
key ,or 'BREAK'."
 1340 COLOUR1:PRINT''';"  PRESS AN
Y KEY TO CONTINUE":WAIT=GET
 1350 ENDPROC
```

Graph 2 by Ann Kitchen.

```
>REM THIS IS THE LISTING
>REM FOR GRAPH (2)
>REM BY ANN KITCHEN
>LOAD"A.KITCH"
>LIST
   10 REM  GRAPH PLOTTING ROUTINE
   20 REM  Copyright Ann Kitchen,198
2  Stockport Grammar School
   30 MODE7
   40 PRINT''"This program will plot
 curves on the  screen and also pr
int them on a TANDY  COLOR GRAPHIC
PRINTER if it is available"''
   50 PRINT"The curves may be either
 parametric or  cartesian in form an
d any limits may be selected. These
may be entered as 4*PI  or LN(4) if
desired but must be a"
   60 PRINT"recognised BASIC express
ion."
   70 PRINT''"PRESS ANY KEY TO START
"
   80 A$=GET$
   90 IF A$="" THEN 80
  100 CLS
  110 ERR=0
  120 CC=1
  130 MODE4
  140 XL$="-10":XH$="10":YL$="-10":Y
H$="10"
  150 TX$="T":TY$="T":Y$="X"
  160 TL$="0":TH$="4*PI"
  170 K$="M"
  180 PRINT"ARE COORDINATES CARTESIA
N OR PARAMETRIC C/P"
  190 C$=GET$
  200 PRINT"DO YOU WANT PRINTED OUTP
UT Y/N"
  210 P$=GET$
  220 PROCINIT
  230 IF C$="C" THEN GOTO 430
  240 IF C$="P" THEN GOTO 1190
  250 IF P$="Y" THEN VDU2:PRINT"H":V
DU1,17,10,10,10:VDU3
  260 PRINT"ANOTHER GRAPH Y/N"
  270 A$=GET$:IF A$="Y" THEN 180
  280 MODE7:END
  290 REM ************************
********
  300 DEFPROCLIMX
  310 CLS
  320 PRINTTAB(0,2);"DO YOU WANT TO
CHANGE LIMITS ";XL$;"<X<";XH$,YL$"<
Y<";YH$;"  Y/N"
  330 A$=GET$
  340 IF A$="N" THEN 380
  350 CLS:PRINTTAB(0,2);"ENTER XL,XH
,YL,YH"'" WHERE XL<X<XH AND YL<Y<YH
";
  360 INPUT XL$,XH$,YL$,YH$
  370 CLS:GOTO320
  380 XL=EVAL(XL$):YL=EVAL(YL$):XH=E
VAL(XH$):YH=EVAL(YH$)
  390 XINC=(XH-XL)/400:YINC=(YH-YL)/
400
  400 XC=1/XINC:YC=1/YINC
  410 ENDPROC
  420 REM ************************
********
  430 REM ROUTINE FOR CARTESIAN GRAP
H
  440 PROCLIMX
  450 CLG
  460 PROCAX
  470 CLS:PRINTTAB(0,3);"DO YOU WISH
 TO ALTER THE EQUATION Y=";Y$;"  Y/N
"
  480 A$=GET$:IF A$="N"THEN500
  490 PRINT"ENTER EQUATION Y=";:INPU
T Y$
  500 K$="M"
  510 X=XL
  520 ON ERROR GOTO 600
  530 Y=EVAL(Y$)
  540 I=INT((X-XL)*XC):J=INT((Y-YL)*
YC)
  550 IF J>400 THEN J=400:K$="M" ELS
E IF J<0 THEN J=0:K$="M"
  560 PROCDR
  570 IF P$="Y" THEN PROCPR
  580 IF J=400 OR J=0 OR I=400 OR I=
0 THEN K$="M" ELSE K$="D"
  590 GOTO610
  600 IF ERR=180R ERR=20 HEN K$="M":
GOTO610 ELSE REPORT:GOTO250
  610 X=X+XINC*4:IF X<=XH THEN 530
  620 ON ERROR OFF
  630 IF P$<>"Y"THEN700
  640 VDU2
  650 PRINT"Q1"
  660 PRINT"S0"
  670 PRINT"R";30-10*CC;",0"
  680 PRINT"PY=";Y$
  690 PRINT"Q0"
  700 VDU3
  710 CLS:PRINT"Y=";Y$
  720 PRINT XL$;"<X<";XH$,YL$;"<Y<";
YH$
  730 PRINT"ANOTHER CURVE ON THESE A
XES Y,N":R$=GET$
  740 IF R$="N" THEN 820
  750 IF P$<>"Y" THEN 490
  760 CC=CC-1:IF CC<0 THEN CC=3
  770 VDU2
  780 PRINT"C";CC
  790 PRINT"H":VDU3
  800 CLS
  810 GOTO490
  820 CLG:CLS:PRINT"H":VDU3:GOTO250
  830 REM ************************
**********
  840 DEFPROCINIT
  850 IF P$="Y" THENVDU2:VDU1,18:PRI
NT"M0,-400":PRINT"I":PRINT"C0":VDU3
  860 VDU24,0;0;800;800;:VDU28,0,5,3
9,0
  870 ENDPROC
  880 REM ************************
**********
  890 DEFPROCAX
  900 XAX=INT((-XL)*XC)
  910 IF XL>0 THEN XAX=0
  920 IF XH<0 THEN XAX=400
  930 YAX=INT((-YL)*YC)
  940 IF YL>0 THEN YAX=0
  950 IF YH<0 THEN YAX=400
  960 IF P$="Y" THEN VDU2:PRINT"M0,"
;YAX:PRINT"D400,";YAX:PRINT"M";XAX;"
,0":PRINT"D";XAX;",400"
  970 MOVE 0,YAX*2:DRAW 800,YAX*2
  980 MOVE XAX*2,0:DRAW XAX*2,800
  990 IF P$="N"THEN1060
 1000 PRINT"S1"
 1010 PRINT"M0,";YAX-15:PRINT"PX";XL
$:PRINT"M400,";YAX-15:PRINT"PX";XH$:
PRINT"M";XAX;",0":PRINT"PY";YL$:PRIN
T"M";XAX;",400":PRINT"PY";YH$
 1020 PRINT"H"
 1030 PRINT"C3"
 1040 CC=3
 1050 VDU3
 1060 ENDPROC
 1070 REM ************************
************
 1080 DEFPROCDR
 1090 IFK$="M" THEN MOVE I*2,J*2
 1100 DRAW I*2,J*2
 1110 ENDPROC
 1120 REM ************************
************
 1130 DEFPROCPR
 1140 VDU2
 1150 PRINTK$;I;",";J
 1160 VDU3:PRINTTAB(0,0);"
                          ";TAB(0,0)
 1170 ENDPROC
 1180 REM ************************
************
 1190 REM ROUTINE FOR PARAMETRIC CUR
VES
 1200 PROCLIMX
 1210 PROCLIMT
 1220 PROCAX
 1230 K$="M"
 1240 CLS:PRINTTAB(0,5);"DO YOU WISH
 TO ALTER THE EQUATIONS"'" X=";TX$;"
 Y=";TY$;" Y/N"
 1250 A$=GET$:K$="M"
 1260 IF A$="N" THEN 1290
 1270 CLS:PRINTTAB(0,5);"X=";:INPUTT
X$
 1280 PRINTTAB(0,6);"Y=";:INPUTTY$
 1290 T=TL:ON ERROR GOTO1380
 1300 X=EVAL(TX$):Y=EVAL(TY$)
 1310 I=INT((X-XL)*XC):J=INT((Y-YL)*
YC)
 1320 IF J>400 THEN J=400:K$="M" ELS
E IF J<0 THEN J=0:K$="M"
 1330 IF I>400 THEN I=400:K$="M" ELS
E IF I<0 THEN I=0:K$="M"
 1340 PROCDR
 1350 IF P$="Y"THENPROCPR
 1360 IF J=400 OR J=0 OR I=400 OR I=
0 THEN K$="M" ELSE K$="D"
 1370 GOTO1390
 1380 IF ERR=18 OR ERR=20 THEN K$="M
":GOTO1390 ELSE REPORT:GOTO250
 1390 T=T+TINC:IF T<=TH THEN 1300
 1400 ON ERROR OFF
 1410 IF P$<>"Y" THEN 1470
 1420 VDU2
 1430 PRINT"Q1":PRINT"S0";PRINT"R";3
0-10*CC;",0"
 1440 PRINT"PX=";TX$;"  Y=";TY$
 1450 PRINT"Q0"
 1460 VDU3
 1470 CLS:PRINT"X=";TX$,"      Y=";TY
$:PRINTXL$;"<X<";XH$,YL$"<Y<";YH$:PR
INTTL$;"<T<";TH$
 1480 PRINTTAB(0,4);"ANOTHER CURVE O
N THESE AXES Y/N":R$=GET$
 1490 IF R$="N" THEN 1550
 1500 CC=CC-1:IF CC<0 THEN CC=3
 1510 VDU2
 1520 PRINT"C";CC
 1530 PRINT"H":VDU3
 1540 GOTO1240
 1550 CLG:CLS:PRINT"H":VDU3:GOTO250
 1560 REM ************************
**********
 1570 DEFPROCLIMT
 1580 CLS:PRINTTAB(0,2);"DO YOU WISH
 TO ALTER THE LIMITS OF T"'" TL=";TL
$;"  TH=";TH$;"  Y/N"
 1590 A$=GET$
 1600 IF A$="N" THEN 1630
 1610 PRINTTAB(0,5);"TL=";:INPUT TL$
:PRINT"TH=";:INPUT TH$
 1620 CLS:GOTO1580
 1630 TL=EVAL(TL$):TH=EVAL(TH$):TINC
=(TH-TL)/100
 1640 ENDPROC
 1650 REM ************************
**********
```

(continued from previous page)

evaluated, after which axes are drawn and the curve plotted. Further equations may then be superimposed on the same axes, or new axes selected. Each curve on the graph will have a different colour — though they start to repeat after the fourth — and its equation is printed alongside. The end values of the axes are also output to the plotter and printed horizontally or vertically, as appropriate.

In order to overcome the error interrupt generated on division by zero, the main line of the program has been kept free of procedure calls and ForNext statements, both of which invalidate the error-trapping On Error facility which is used to allow, for example, the function $Y = 1/X$ to be plotted through $X = 0$.

Mr Walker's program is for the screen only, and is an exercise in superimposition. Up to 10 equations may be input, amended and deleted, the resulting graphs plotted on selected axes, limits amended and the whole repeated as often as required. The VDU23 character-define command is used to provide axis labelling on screen both horizontally and vertically, and the whole screen is used to give the greatest definition to the result.

The two programs complement each other, each having a separate purpose. I recall spending entire evenings with pencil and graph paper attempting to answer curious arithmetic homework questions; I suppose those of even greater antiquity would have looked askance at my slide rule.

Mr Walker not only wrote his letter and program description on his machine, he also wrote the word processor to do it with, and sent a copy of it to supplement his main contribution. It is very brief, very effective, and for anyone with a printer and no text editor it might prove invaluable.

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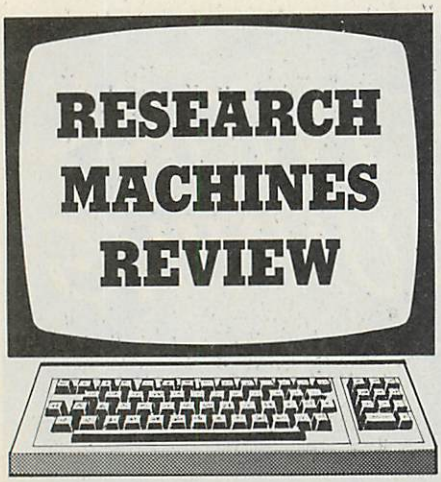
● Circle No. 188



Graphics input

A SHORT GRAPHICS PROGRAM to run on the Research Machines 380-Z comes from S M Roach and G M Bush of Weston-super-Mare, Avon. It enables the user to draw a diagram or picture on to the screen by means of a movable point, controlled via the keyboard. When the program is run the instructions are displayed, and then the computer asks the user to input the position on the screen at which he wishes to begin, that is the X and Y co-ordinates.

When these values have been input, the computer will recognise that point as the origin. This means the final diagram can be moved to any point on the screen. The point selected as the origin will then flash, and the user can move the dot seen on the screen to the desired position. Pressing A will draw a line from the first selected position to the position where the dot is present. The user can then move the dot to another position and draw a line from that point to the last point, and so on.

If, however, the user presses B instead, a line will not be drawn, but a point will be plotted to which the following line will be drawn. If a mistake is made in drawing a line, pressing the Delete key will erase it. When the picture is complete, pressing Z will ask the user to input a file name, and the picture will then be saved under that name.

When saving is complete, the screen will be cleared and the diagram that has been saved will be redrawn on the screen and the user will then be asked if they wish to continue: if so the computer will reopen the file and flash the original again, but the point will move from where it left off before. The next line will be drawn to the origin, unless the point is plotted instead. When completed, the new picture will be saved under the same name as before.

These picture files can be accessed during any program by:

DimQ(500)Z(500)
K — x co-ordinate to change origin
L — y co-ordinate to change origin
B$ — filename

and copying lines 610 to 730 from the program. The program does not allow for simply seeing what is on a file, but this can be done by typing 610, instead of copying lines 610 to 730.

The main features of the program are:

Lines 10-310 set up the program and give instructions.
Line 320 flashes the origin.
Lines 340-500 move a point and save desired points in arrays of Q and Z. A line will be drawn from point to point unless -999 is found in the array, in which case a point will be plotted instead.
Lines 510-9999 are used as the End of File marker.
Lines 520-600 saves all the points in the arrays of Q and Z.
Lines 610-730 are the routine for displaying the contents of the file on the screen, noting the origin, and the plot markers from the file.
Lines 740-860 are a routine to reoopen file and move to the End of File marker, erase the marker and continue the drawing, leaving the file open to save the rest of the picture when the user has fininshed.

Graphics input.

```
10 REM ***********  GRAPHICS PROGRAM EXTRA-ORDINAIRE  ***********
20 REM
30 REM                          WRITTEN BY
40 REM
50 REM ++++++++++    G. ROACH        AND        G. BUSH   ++++++++++++
60 REM              /+/+/+/+/+/+                /+/+/+/+/+
70 REM ************************************************************
80 ON BREAK GOTO 872
90 ?CHR$(31);PUT27,"=1C"
100 CALL"RESOLUTION",0,2
110 ?:?:?"     THIS PROGRAM ENABLES YOU TO DRAW A PICTURE ON THE SCREEN USING A"
120 ?:?"                          MOVING POINT."
130 PUT27,"=0C"
140 ?:?:?TAB(10);"I = UP-LEFT"TAB(30);"P = UP"TAB(50);"9 = UP-RIGHT"
150 ?:?TAB(10);"L = LEFT"TAB(50);"; = RIGHT"
160 ?:?TAB(10);", = DOWN-LEFT"TAB(30);". = DOWN"TAB(50);"/ = DOWN-RIGHT"
170 PUT27,"=1C"
180 ?:?:?"           WHEN YOU WISH TO DRAW A LINE "CHR$(34)"A"CHR$(34)" MUST BE
 PRESSED"
190 ?:?"           IF YOU WISH TO MOVE WITHOUT DRAWING PRESS ":CHR$(34);"B":CHR
$(34)
200 ?:?"                 "CHR$(34)"Z"CHR$(34)" WILL END THE DRAWING SESSION"
210 A$=GET$(0):A$=GET$()
220 CLEAR2000
230 DIM Q(500),Z(500)
240 CALL"RESOLUTION",0,2
250 ?CHR$(31):?:?:?:?"FIRSTLY INPUT THE COORDS OF THE FIRST POINT"
260 ?:?:?"      1st VALUE  - 0 ( VALUE ( 319
270 ?:?"      2nd VALUE  - 0 ( VALUE ( 191
280 ?
290 INPUTK,L
300 IFK(0ORK)320RL(0ORL)191THEN250
310 CALL"OFFSET",-K,-L
320 PUT12:FOR LOOP =1 TO 10:CALL"PLOT",0,0,0:FORDEL=0TO100:NEXT:CALL"PLOT",0,0,3
:FORDEL=0TO100:NEXT:NEXT
330 IFD$="Y"THEN?"YOU CAN CONTINUE NOW!!!"
340 X1=1
350 REM ************  ROUTINE TO MOVE POINT  **************
360 A$=GET$(2):A$=GET$()
370 IFA$="Z"THEN512
380 IFA$="P"THENY=Y+1:CALL"PLOT",X,Y-1,2
390 IFA$="."THENY=Y-1:CALL"PLOT",X,Y+1,2
400 IFA$=";"THENX=X+1:CALL"PLOT",X-1,Y,2
410 IFA$="L"THENX=X-1:CALL"PLOT",X+1,Y,2
420 IFA$="O"THENX=X-1:Y=Y+1:CALL"PLOT",X+1,Y-1,2
430 IFA$="9"THENX=X+1:Y=Y+1:CALL"PLOT",X-1,Y-1,2
440 IFA$="/"THENX=X+1:Y=Y-1:CALL"PLOT",X-1,Y+1,2
450 IFA$=","THENX=X-1:Y=Y-1:CALL"PLOT",X+1,Y+1,2
460 CALL"PLOT",X,Y,3
470 IFA$="A"THENQ(X1)=X:Z(X1)=Y:CALL"PLOT",Q(X1-1),Z(X1-1),3:CALL"LINE",X,Y,3:X1
=X1+1
480 IFA$="B"THENQ(X1)=-999:Q(X1+1)=X:Z(X1)=-999:Z(X1+1)=Y:CALL"PLOT",X,Y,3:X1=X1
+2
490 IFA$=CHR$(127)THENQ(X1-1)=-999:Z(X1-1)=-999:Q(X1)=X:Z(X1)=Y:CALL"PLOT",Q(X1-
2),Z(X1-2),0:CALL"LINE",X,Y,0:X1=X1+1
500 GOTO360
510 Q(X1)=-9999
520 REM **************  CREATE AND WRITE TO FILE  ***************
530 IFD$()"Y"THEN?"INPUT THE FILENAME":INPUTB$
540 IFD$()"Y"THENCREATE#10,B$
550 IFD$()"Y"THENOPEN#10,B$
560 FORX1=1TO500
570 PRINT#10,Q(X1)
580 PRINT#10,Z(X1)
590 NEXT
600 CLOSE#10
610 REM **************  DISPLAY DIAGRAM ON FILE  ****************
620 OPEN#10,B$:CALL"CLEAR":PUT12
630 CALL"OFFSET",-K,-L
640 ONEOFGOTO730
650 CALL"PLOT",0,0,0
660 FORX1=1TO500
670 INPUT#10,Q(X1)
680 INPUT#10,Z(X1)
690 IFQ(X1)=-999THENINPUT#10,Q(X1+1):INPUT#10,Z(X1+1):CALL"PLOT",Q(X1+1),Z(X1+1)
,3:X1=X1+1:GOTO720
700 IFQ(X1)=-9999THEN730
710 CALL"LINE",Q(X1),Z(X1),3
720 NEXT
730 CLOSE#10
740 REM **************  ADD TO FILE OPTION  ***************
750 ?:?:?:?:?"DO YOU WISH TO CONTINUE"
760 D$=GET$(0):D$=GET$():IFD$()"Y"ANDD$()"N"THEN760ELSEIFD$="Y"THEN770ELSEEND
770 OPEN#10,B$
780 RENAME"A:NEWFILE",B$
790 OPEN#10,"A:NEWFILE
800 CREATE=10,B$
810 ONEOFGOTO850
820 INPUT#10,Z:IFZ=-9999THEN850
830 PRINT#10,Z
840 GOTO820
850 ERASE"A:NEWFILE"
860 GOTO320
870 PUT27,"=0C"
```

GALAXY 2 COMPUTER SYSTEM

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- ★ 64K Dynamic RAM
- ★ RS232 Serial Interface
- ★ Two 8-Bit I/O Ports
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- ★ Extended and Page Addressing Modes

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161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190
191	192	193	194	195	196	197	198	199	200	201	202	203	204	205
206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235
236	237	238	239	240	241	242	243	244	245	246	247	248	249	250
251	252	253	254	255	256	257	258	259	260	261	262	263	264	265
266	267	268	269	270	271	272	273	274	275	276	277	278	279	280
281	282	283	284	285	286	287	288	289	290	291	292	293	294	295
296	297	298	299	300	301	302	303	304	305	306	307	308	309	310
311	312	313	314	315	316	317	318	319	320	321	322	323	324	325
326	327	328	329	330	331	332	333	334	335	336	337	338	339	340
341	342	343	344	345	346	347	348	349	350	351	352	353	354	355
356	357	358	359	360	361	362	363	364	365	366	367	368	369	370
371	372	373	374	375	376	377	378	379	380	381	382	383	384	385
386	387	388	389	390	391	392	393	394	395	396	397	398	399	400
401	402	403	404	405	406	407	408	409	410	411	412	413	414	415
416	417	418	419	420	421	422	423	424	425	426	427	428	429	430

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APPLE PIE

by John Harris

Simon

THE GAME of Simon is available commercially, though not necessarily on a computer. It is essentially a memory test, with the program playing a sequence of notes to which it adds one more each time you demonstrate your retention of what has gone so far.

Running the program by J Bamford of Wells, Somerset, I have reached 15 but Mr Bamford, possibly optimistically, has set the game to push on as far as 100 before admitting defeat. Mr Bamford claims that line 430 contains three embedded Control-G characters; it would take a better man than I to prove him wrong.

Enhanced File indexing

In November 1982 this column carried a File Index utility by Mr A Hourd of

(continued on page 173)

Enhanced file indexing.

```
10  ONERR  GOTO 9900
20 GM = 0
100  TEXT : HOME
110  HTAB 3: PRINT " ************
     **********************"
115  HTAB 3: PRINT " *
                          *"
120  HTAB 3: PRINT " *   MASTER C
     ATALOGUE OF DISKS   *"
130  HTAB 3: PRINT " *
                          *"
140  HTAB 3: PRINT " ************
     **********************"
150  VTAB 10: HTAB 4: PRINT "CHOO
     SE FROM :-": VTAB 12: HTAB 1
     0
160  PRINT "1. MAKING A CATALOGUE
     "
170  PRINT : HTAB 10: PRINT "2. R
     EADING A CATALOGUE"
172  PRINT : HTAB 10: PRINT "3. C
     ATALOG"
175  PRINT : HTAB 10: PRINT "4. Q
     UIT THE PROGRAM."
180  PRINT : PRINT : PRINT "PRESS
      1-4 ";
190  GET A$:AC =  VAL (A$)
192  IF AC < 1 OR AC > 4 THEN 190

195  IF AC = 3 THEN  GOSUB 12000:
      RUN
200  ON AC GOTO 1000,4000,100,146
     0
1000  REM ************************
     **
1010  REM *** DISK FILE INDEX DOS
      3.3 ***
1020  REM ************************
     **
1030  HIMEM: 34000
1040  TEXT : HOME : PRINT
1050  HTAB 8: PRINT "************
     ************"
1060  HTAB 8: PRINT "*** DISK FIL
     ES INDEX ***"
1070  HTAB 8: PRINT "************
     ************"
1080  VTAB 20: HTAB 8: PRINT "PRE
     SS SPACE WHEN READY.";
1090  GET AN$: IF AN$ <  > " " THEN
      1090
1100  PRINT
1110 BA = 34500:TR = 1:FA = 0:EF =
     0:AD = 768:ID = AD + 9:TW =
     2
1120  REM *** NAMES OF FILES IN N
     A$() DIMENSIONED FOR 500 FIL
     ES ***
1130  REM ************
1140  DIM NA$(500)
1150 S3$ = "000"
1160  TEXT : HOME
1170  PRINT "PUT FIRST DISK IN,EN
     TER ITS I.D.": PRINT
1180  PRINT : INPUT "(ONLY 4 CHAR
     S PLEASE)  ";DN$
1190  IF  LEN (DN$) < 4 THEN DN$ =
      DN$ + " ": GOTO 1190
1200  IF  LEN (DN$) > 4 THEN 1180

1210  PRINT : PRINT : FLASH : PRINT
      " WORKING....PLEASE WAIT ": NORMAL
     : PRINT
1220 EN = 0
1230  GOSUB 1480
1240  REM  ***SHELL-METZNER SORT
     ***
1250  HOME : VTAB 10: PRINT  CHR$
     (7)"NOW WAIT WHILE ";EN;" FI
     LES ARE SORTED.": PRINT : FLASH
     : PRINT " DO NOT INTERRUPT..
     .....": NORMAL
1260  GOSUB 2310
1270  PRINT  CHR$ (7) CHR$ (7) CHR$
     (7)
1280  REM   *** END OF SORT ROUTI
     NE ***
1285 EF = 0
1290  GOSUB 2100
1295 EF = 1
1300  HOME : PRINT : PRINT "HARD
     COPY ?(Y/N)"
1310  GET Z$: IF Z$ = "N" THEN 14
     50
1320  IF Z$ <  > "Y" THEN 1310
1330  HOME : VTAB 5: PRINT " MAKE
      SURE A PRINTER IS CONNECTED
      !!": PRINT "THEN PRESS SPAC
     E TO GO ON."
1340  GET AN$: IF AN$ <  > " " THEN
      1340
1350  PRINT : PRINT  CHR$ (4)"PR£
     1"
1360  REM  *** COULD NEED 'PRINT
     CHR$(9);"BON" FOR SOME PRINT
     ERS ***
1370  PRINT : PRINT  SPC( 15);"MA
     STER CATALOGUE   PAGE1": PRINT

1380  FOR X = 1 TO EN
1390  PRINT  SPC( 10); LEFT$ (NA$
     (X),1); SPC( 2); MID$ (NA$(X
     ),2,20);
1400  PRINT  SPC( 2); MID$ (NA$(X
     ),22,3); SPC( 2);"DISK "; RIGHT$
     (NA$(X),4)
1410  IF X / 55 =  INT (X / 55) THEN
      PRINT  CHR$ (12): PRINT : PRINT
     : PRINT  SPC( 15);"MASTER CA
     TALOGUE     PAGE "; INT (X /
     55) + 1: PRINT
1420  NEXT
1430  PRINT : PRINT  CHR$ (4);"PR
     £0"
1440  PRINT  CHR$ (7) CHR$ (7) CHR$
     (7) CHR$ (7) CHR$ (7)"FINISH
     ED"
1450  IF GM <  > 1 THEN  GOSUB 21
     00
1455  VTAB 22: PRINT "PRESS SPACE
      TO GO ON"
1456  GET A$: IF A$ <  > " " THEN
      1456
1457  RUN
1460  GOSUB 2270: HOME : PRINT "'
     BYE FOR NOW."
1465  POKE 216,0
1470  VTAB 5: FLASH : PRINT " RET
     URNING TO DISK MENU ": NORMAL
     : PRINT : PRINT  CHR$ (4)"RU
     NMENU"
1480 PO = 0:RS = 0:SC = 0
1490  REM  *** RESET ALL PARAMETE
     RS FOR EACH DISK ***
1500  GOSUB 1950
1510 BP = BA - 256:NT = 17:NS = 1
     5
1520  REM  *** MAIN LOOP FOR READ
     ING EACH DISK CATALOG ***
1530 BP = BP + 256
1540  POKE ID + 9, INT (BP / 256)
     : POKE ID + 4,NT: POKE ID +
     5,NS
1550  CALL 768
1560  GOSUB 2010
1570  IF EF = TR THEN 2030
1580 SC = SC + 1:NT =  PEEK (BP +
     1):NS =  PEEK (BP + 2)
1590  IF NT > 0 AND NS > 0 THEN 1
     530
1600  REM  *** PUSH DATA INTO STR
     INGS ***
1610  FOR CS = 1 TO SC
1620  FOR SE = 1 TO 7
1630 RS = (BA - 256) + (CS * 256)
      + 11 + (SE - 1) * 35
1640 FT =  PEEK (RS + 2)
1650  IF ( PEEK (RS) = 255) OR ( PEEK
     (RS + 33) = 0) THEN 1800
1660 EN = EN + 1: REM *** UPDATE
     NO. OF ENTRIES ***
1670  IF FT >  = 128 THEN FT = FT
      - 128: REM *** IGNORE LOCKE
     D CODE ***
1680  IF FT = 0 THEN FT$ = "T": GOTO
      1730
1690  IF FT = 1 THEN FT$ = "I": GOTO
      1730
1700  IF FT = 2 THEN FT$ = "A": GOTO
      1730
1710  IF FT = 4 THEN FT$ = "B": GOTO
      1730
1720 FT$ = "?": REM *** ONE OF TH
     E UNUSUAL FILE TYPES.EG. 'R'
      ***
1730 FS =  PEEK (RS + 33):FS$ = S
     3$ +  STR$ (FS):FS$ =  RIGHT$
     (FS$,3)
1740 NA$(EN) = ""
1750  FOR PO = 1 TO 20
1760 N$ =  CHR$ ( PEEK (RS + TW +
     PO))
1770 NA$(EN) = NA$(EN) + N$
1780  NEXT
1790 NA$(EN) = FT$ + NA$(EN) + FS
     $ + DN$
1800  NEXT
```

(listing continued on page 173)

Simon.

```
100  REM  SIMON BY J.BAMFORD 1983

110  GOTO 1010
200  REM SUB ROUTINE TO PLAY NOTE
      AND DISPLAY KEY NUMBER
210  POKE 38377,128: HTAB (21): PRINT
     "4";: GOTO 260
220  POKE 38377,171: HTAB (20): PRINT
     "3";: GOTO 260
230  POKE 38377,203: HTAB (19): PRINT
     "2";: GOTO 260
240  POKE 38377,0: HTAB (18): PRINT
     "1";: GOTO 260
250  POKE 38377,64
260  POKE 38378,DR: REM  POKE DUR
     ATION
270  CALL 38379: REM  PLAY NOTE
280  HOME : REM  CLEAR SCREEN OF
     KEY NUMBER
290  RETURN : REM  END OF SUBROUT
     INE
400  REM GAME STARTS HERE
410  HOME : PRINT "HERE WE GO....
     ..": FOR W = 1 TO 1000: NEXT
     W:K = 0: REM  CLEAR SCREEN,
     PRINT, WAIT, START NEW GAME
420 K = K + 1: REM  INCREMENT SEQ
     UENCE COUNTER
430  IF K > MN THEN  PRINT "YOU W
     IN.": END
440 TABLE(K) =  INT ( RND (1) * 4
      + 1): REM SET KEY NUMBER FO
     R NEXT NOTE IN TABLE
450 DUMMY =  PEEK (49168): REM  C
     LEAR KEYBOARD STROBE
460  REM NOW PLAY NOTE SEQUENCE
470  FOR C = 1 TO K
480  ON TABLE(C) GOSUB 240,230,22
     0,210: REM PLAY NOTE
490  NEXT
500  FOR C = 1 TO K
510  GET A$:B =  ASC (A$) - 48: REM
      GET KEY AND CONVERT TO NUMBE
     R
520  IF B = 0 THEN  HOME : PRINT
     "BYE";: END
530  IF B < 1 OR B > 4 THEN 510: REM
      CHECK FOR SUITABLE KEY
540  IF B <  > TABLE(C) THEN  GOSUB
      250: PRINT "YOUR SCORE WAS "
     K - 1" THAT TIME.":FLAG = 1:
     C = K: GOTO 560: REM IF WRON
     G KEY,END GAME,PRINT SCORE,E
     XIT CLEANLY FROM FOR LOOP
550  ON B GOSUB 240,230,220,210: REM
      PLAY NOTE
560  NEXT C
570  FOR W = 1 TO 1000: NEXT W: REM
      WAIT
580  IF FLAG = 1 THEN FLAG = 0: GOTO
      410: REM START NEW GAME
590  GOTO 420
1000  REM INITIALIZE MACHINE
1010  HIMEM: 38376: PRINT : PRINT
      CHR$ (4)"PR£0": NORMAL : HOME
1020 MN = 100: REM SET MAXIMUM NU
     MBER OF NOTES
1030  DIM TABLE(MN)
1040  REM POKE SUBROUTINE TO PLAY
      NOTES
1050  POKE 38379,173: POKE 38380,
      48: POKE 38381,192: POKE 383
     82,136: POKE 38383,208: POKE
     38384,5: POKE 38385,206: POKE
     38386,234: POKE 38387,149: POKE
     38388,240: POKE 38389,9
1060  POKE 38390,202: POKE 38391,
      208, POKE 38392,245: POKE 38
     393,174: POKE 38394,233: POKE
     38395,149: POKE 38396,76: POKE
     38397,235: POKE 38398,149: POKE
     38399,96
1070  REM PRINT INSTRUCTIONS
1080  PRINT "THIS PROGRAM PLAYS '
     SIMON'.": PRINT
1090  PRINT "SPEED (0-9) / "; GET
     A$: PRINT A$:SP =  ASC (A$)
      - 48: REM GET KEY,PRINT IT,
     AND CONVERT TO A NUMBER
1100  IF SP < 0 OR SP > 9 THEN  HTAB
      (1): GOTO 1090: REM IF VALUE
      UNACCEPTABLE, GET ANOTHER K
     EY
1110  PRINT : PRINT :DR =  INT (2
     50 / (10 ^ (SP / 9))): REM S
     ET DURATION OF NOTES
1120  PRINT "USE THE KEYS 1 TO 4
      TO ENTER YOUR NOTES.": PRINT

1130  PRINT "PRESS 0 WHEN YOU ARE
      READY TO START.": PRINT
1140  PRINT "PRESS 0 AGAIN WHEN Y
     OU WANT TO STOP.": PRINT
1150  PRINT "TRY THE KEYS 1 TO 4
     NOW.": PRINT
1160  GET A$:B =  ASC (A$) - 48: HOME
     : REM GET KEY,CONVERT TO NUM
     BER,CLEAR SCREEN
1170  IF B = 0 THEN 410: REM STAR
     T GAME
1180  IF B  1 OR B  4 THEN 1160
      REM              CHECK FOR SU
     ITABLE KEY
1190  ON B GOSUB 240,230,220,210:
      REM PLAY NOTE
1200  GOTO 1160
```

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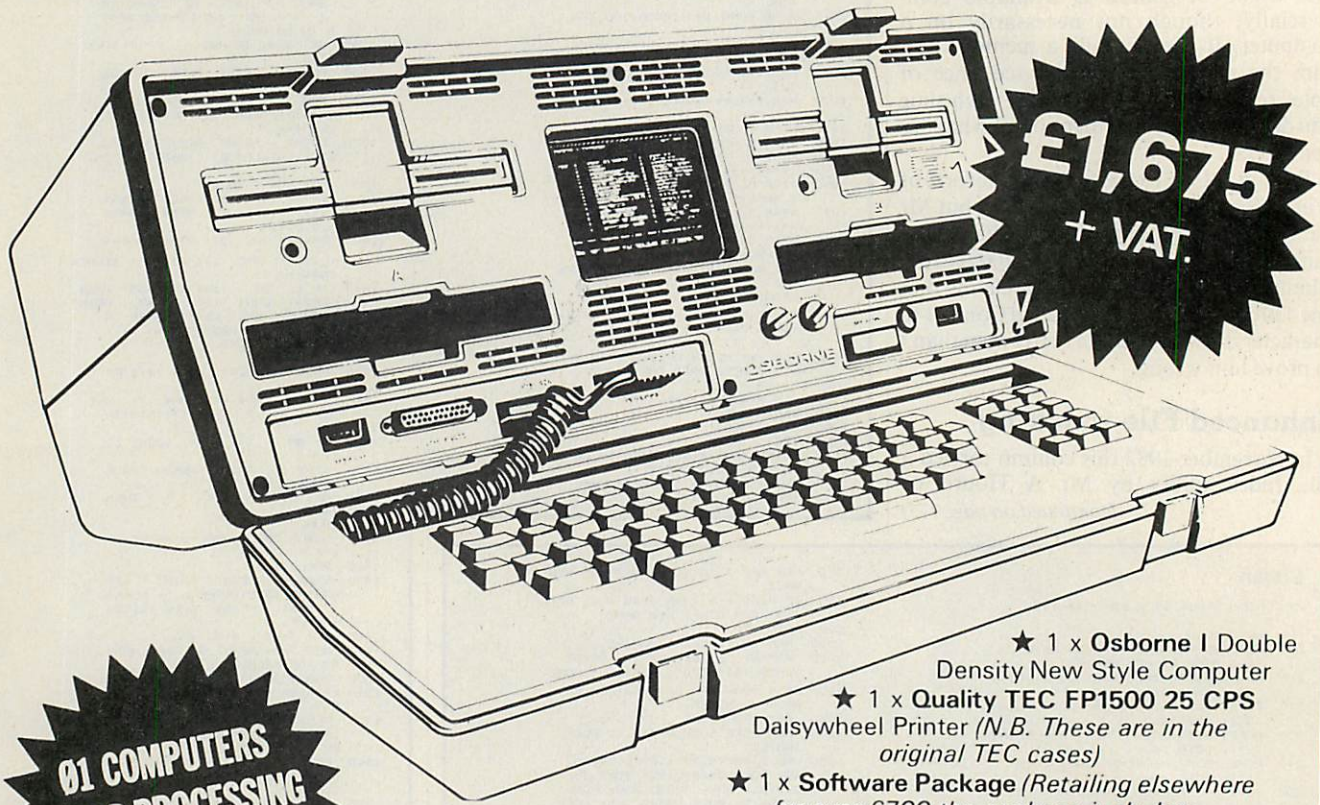

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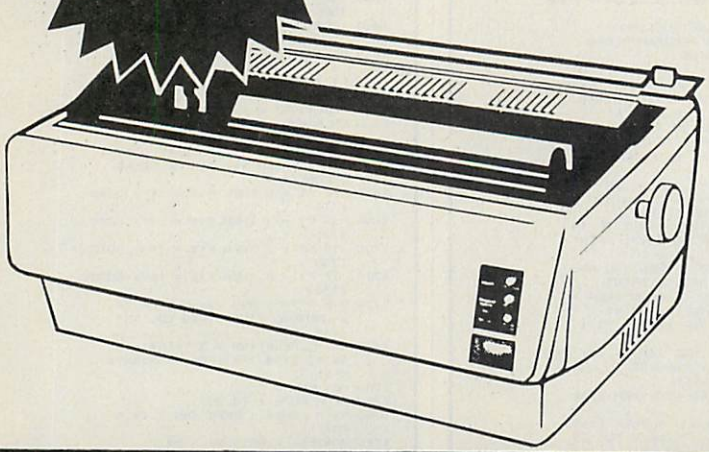

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(listing continued from page 171)

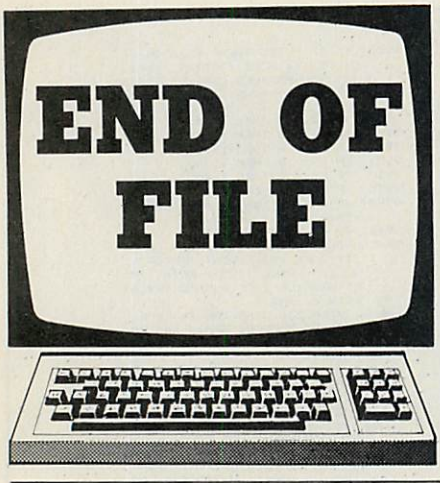
```
1810  NEXT
1820 X9 =  FRE (0)
1822  HOME : PRINT : PRINT EN" FI
     LES READ SO FAR": PRINT
1830  PRINT : PRINT "ANOTHER DISK
     TO DO ?(Y/N)";
1840  GET AN$: PRINT AN$: IF AN$ =
     "N" THEN  RETURN
1850  IF AN$ <  > "Y" THEN 1830
1852  VTAB 5: PRINT "
                                  "
1860  PRINT "FREE MEMORY = ";X9
1870  PRINT : PRINT "(LAST DISK R
     EF. WAS ";DN$" )"
1880  PRINT : PRINT "PUT NEXT DIS
     K IN,ENTER ITS I.D."
1890  PRINT : INPUT "(ONLY 4 CHAR
     S. REMEMBER!)";DN$
1900  IF  LEN (DN$) < 4 THEN DN$ =
     DN$ + " ": GOTO 1900
1910  IF  LEN (DN$) > 4 THEN 1890

1920  PRINT : FLASH : PRINT " WOR
     KING.....PLEASE WAIT ": NORMAL
     : PRINT
1930  GOTO 14B0
1940  REM  *** DISK READ SUBROUTI
     N AND PARAMETER TABLE ***
1950  RESTORE
1960  FOR X = 0 TO 29: READ Y: POKE
     AD + X,Y: NEXT : RETURN
1970  DATA 169,3,160,9,32,217,3,9
     6,0,1,96,1,0,17,15,26,3,196,
     134,0,0,1,0,0,98,1,0,1,239,2
     16
1980  REM  *** ERROR CHECKING ROU
     TINE ***
1990  REM  *** RETURNS ERROR CODE
      AS PAGE 97 OF DOS MANUAL (I
     BSTAT) ***
2000  REM  *** IN DECIMAL, NOT HE
     X !!! ***
2010  IF  PEEK (IO + 13) = 0 THEN
     EF = FA: RETURN
2020 EF = TR: RETURN
2030  PRINT : CALL  - 1052: CALL
      - 1052
2040  PRINT "ERROR NO. "; PEEK (I
     O + 13);" TRACK ";INT;" SECTO
     R ";NS
2050  PRINT : PRINT "YOU CAN TRY
     SAME DISK AGAIN OR PUT IN A"

2060  PRINT : PRINT "FRESH DISK W
     ITH A NEW I.D."
2070  PRINT : PRINT : PRINT "PRES
     S SPACE TO CONTINUE...";
2080  GET AN$: IF AN$ <  > " " THEN
     2080
2090  GOTO 1B20
2100  TEXT : HOME
2110  PRINT : PRINT "SAVE TO DISK
     ? (Y/N)"
2120  GET AN$: IF AN$ = "N" THEN
     HOME : PRINT "'BYE FOR NOW
     THEN": RETURN
2130  IF AN$ <  > "Y" THEN 2120
2140 GM = 1:JW = 1
2150 D$ =  CHR$ (4)
2160  PRINT : PRINT "TYPE IN THE
     NAME YOU WANT THIS FILE": PRINT
     "TO HAVE      ": INPUT FI$
2170  PRINT : PRINT D$;"OPEN";FI$

2180  PRINT : PRINT D$"DELETE";FI
     $
2190  PRINT : PRINT D$"OPEN";FI$
2200  PRINT : PRINT D$;"WRITE";FI
     $
2210  PRINT EN
2220  FOR K = 1 TO EN: PRINT NA$(
     K): NEXT
2230  PRINT : PRINT D$;"CLOSE";FI
     $
2240  PRINT : PRINT D$;"LOCK";FI$

2250  TEXT : HOME
2260  PRINT  CHR$ (7) CHR$ (7): PRINT
      : PRINT "FINISHED": RETURN
```

(continued from page 171)

Brundell, Norfolk. Since then enhanced versions based on this original have been sent in, with the intention of improving the sort — which, as Mr Hourd confessed at the time, was atrocious — and providing a hard-copy back-up to disc in case of printer failure during the final printing stage. It is silly to spend 10 minutes on a utility only to have to repeat the exercise from the beginning when you find the paper was misaligned, for instance.

One of these enhanced versions we are printing this month. It is admittedly very long, and not easy for those who keyed the original to merely type in modifications to what they have. Mr G Miles of Auchinleck Academy has provided a very thorough error-checking routine and a greatly enhanced sort. The resulting utility is a solid usable result which is worth printing in full, despite the apparent duplication of a previous submission.

```
2270  TEXT : HOME : PRINT : PRINT
     "ANOTHER RUN ?(Y/N)"
2280  GET Z$: IF Z$ = "N" THEN  RETURN


2290  IF Z$ <  > "Y" THEN 2280
2300  RUN
2310 ZC = 0:ZS = 0:ZA = 1:ZN = BN
2320  IF Z > ZA > ZN THEN 2350
2330 ZA = ZA + 1
2340  GOTO 2320
2350 ZF = Z - ZA - 1
2360 ZF =  INT (ZF / 2)
2370  IF ZF = 0 THEN  RETURN
2380 ZD = ZN - ZF
2390 ZB = 1
2400 ZA = ZB
2410 ZE = ZA + ZF
2420 ZC = ZC + 1
2430  IF NA$(ZA) > NA$(ZE) THEN 2
     470
2440 ZB = ZB + 1
2450  IF ZB > ZD THEN 2360
2460  GOTO 2400
2470 ZS = ZS + 1
2480 ZT$ = NA$(ZA):NA$(ZA) = NA$(
     ZE):NA$(ZE) = ZT$
2490 ZA = ZA - ZF
2500  IF ZA < 1 THEN 2440
2510  GOTO 2410
4000  GOSUB 4340
4010  PRINT : PRINT  CHR$ (4)"OPE
     N";FI$
4020  PRINT : PRINT  CHR$ (4)"REA
     D"FI$
4030  INPUT N
4040  DIM N$(N)
4050  FOR K = 1 TO N
4060  INPUT N$(K): NEXT
4070  PRINT : PRINT  CHR$ (4)"CLO
     SE"FI$
4080  TEXT : HOME : PRINT  CHR$ (
     7) CHR$ (7)
4090  PRINT : PRINT "HARD COPY ?
     (Y/N)"
4100  GET Z$: IF Z$ = "Y" THEN 42
     20
4110  IF Z$ <  > "N" THEN 4100
4120  TEXT : HOME : PRINT CH$
4130  PRINT
4140  POKE 34,2
4150  FOR K = 1 TO N
4160  PRINT  LEFT$ (N$(K),1); SPC(
     2); MID$ (N$(K),2,20);
4170  PRINT  SPC( 2); MID$ (N$(K)
     ,22,3); SPC( 2);"DISK "; RIGHT$
     (N$(K),4)
4180  IF (K / 18) =  INT (K / 18)
     THEN  GOSUB 4310
4190  NEXT
4200  POKE 34,0
4210  GOTO 4510
4220  PRINT : PRINT  CHR$ (4)"PRE
     1"
4230  PRINT : PRINT  SPC( 10);CH$
     ; SPC( 6);"PAGE 1": PRINT : PRINT


4240  FOR K = 1 TO N
4250  PRINT  SPC( 15); LEFT$ (N$(
     K),1); SPC( 2); MID$ (N$(K),
     2,20);
4260  PRINT  SPC( 2); MID$ (N$(K)
     ,22,3); SPC( 2);"DISK "; RIGHT$
     (N$(K),4)
4270  IF K / 55 =  INT (K / 55) THEN
      PRINT  CHR$ (12): PRINT : PRINT
     : PRINT  SPC( 15);CH$; SPC(
     6);"PAGE "; INT (K / 55) + 1
     : PRINT : PRINT
4280  NEXT
4290  PRINT : PRINT  CHR$ (4)"PRE
     .O"
4300  GOTO 4510
4310  INVERSE : PRINT : PRINT : PRINT
     "PRESS SPACE FOR THE REST":
     NORMAL
4320  GET Z$: IF Z$ <  > " " THEN
     4320
4330  HOME : RETURN
4340  TEXT : HOME
4350  PRINT : PRINT  SPC( 5):: INVERSE

     : PRINT " MASTER CATALOGUE F
     ILE READER ": NORMAL
4360  VTAB 5: HTAB 2: PRINT "IS D
     ATE REQUIRED ?(Y/N)"
4370  GET Z$: IF Z$ = "N" THEN MT
     $ = "":YN$ = "": GOTO 4430
4380  IF Z$ <  > "Y" THEN 4370
4390  VTAB 5: HTAB 2: PRINT "ENTE
     R MONTH AS WORD       ": INPUT
     MT$
4400  IF MT$ = "" THEN 4390
4410  VTAB 7: HTAB 2: PRINT "ENTE
     R YEAR (EG. 1982)": INPUT YN
     $
4420  IF YN$ = "" THEN 4410
4430  PRINT : PRINT "TYPE IN A HE
     ADING THEN PRESS RETURN"
4440  INPUT CH$
4450  IF CH$ = "" THEN CH$ = "MAS
     TER CATALOGUE"
4460 CH$ = CH$ + "   " + MT$ + "
     " + YN$
4470  TEXT : HOME : PRINT : PRINT
     "ENTER NAME OF FILE TO BE RE
     AD": INPUT FI$
4480  IF FI$ = "" THEN 4470
4485 JW = 0
4490  TEXT : HOME : FLASH : PRINT
     : PRINT " READING ";FI$;" "
4500  NORMAL : RETURN
4510  PRINT : PRINT "READ ANOTHER
     FILE ? (Y/N)";
4520  GET Z$: IF Z$ = "N" THEN  RUN

4530  IF Z$ <  > "Y" THEN 4520
4540  CLEAR : GOTO 4000
9900  REM *** ERROR MESSAGES ***
9902  TEXT : HOME : PRINT  CHR$ (
     7) CHR$ (7)
9905 ER =  PEEK (222)
9910  IF ER = 255 THEN  POKE 216,
     0: TEXT : HOME : PRINT  CHR$
     (7)"YOU PRESSED CTRL-C": PRINT
     : PRINT : PRINT "'BYE FOR NO
     W": END
9915  IF ER = 4 THEN 11100
9917  IF ER = 5 THEN 11150
9920  IF ER = 6 THEN 11200
9925  IF ER = 8 THEN 11300
9930  IF ER = 9 THEN 11400
9935  IF ER = 10 THEN 11500
9940  IF ER = 11 OR ER = 16 THEN
     11600
9942  IF ER = 13 THEN 11700
9945  POKE  - 16303,0: PRINT  CHR$
     (7) CHR$ (7): PRINT "ERROR N
     O....";  PEEK (222): PRINT "G
     ET HELP OR TYPE RUN TO TRY A
     GAIN.": END
10000  VTAB 23: HTAB 10: INVERSE
     : PRINT " PRESS SPACE BAR TO
     GO ON "
10005  NORMAL
10010 Z =  PEEK ( - 16384) - 128
10020  IF Z = 32 THEN  POKE  - 16
     368,0: RETURN
10030  GOTO 10010
11000  REM ***** ERROR HANDLING R
     OUTINES ***
11100  PRINT : PRINT "YOU CANNOT
     RECORD ON THIS DISK! IT IS"
11110  PRINT "WRITE PROTECTED. RE
     MOVE THE TAPE ON THE"
11120  PRINT "RIGHT HAND SIDE OF
     THE DISK THEN TRY"
11130  PRINT "AGAIN."
11140  GOTO 13000
11150  PRINT : PRINT "THAT FILE D
     IDN'T EXIST ON THIS DISK,OR"
     : PRINT "ELSE IT DIDN'T HAVE
     ANY INFORMATION IN"
11155  PRINT "IT.": PRINT : PRINT
     "TRY AGAIN.": GOTO 14000
11200  PRINT : PRINT "THERE'S NO
     FILE/PROGRAM/PICTURE/DISPLAY
     "
11210  PRINT "OF THAT NAME ON THI
     S DISK. EITHER CHECK"
11220  PRINT "YOUR SPELLING OR TR
     Y ANOTHER DISK."
11230  GOTO 13000
11300  PRINT : PRINT "THERE'S AN
     INPUT/OUTPUT ERROR (I/O):"
11310  PRINT "THE COMMON CAUSES O
     F THIS ARE:-": PRINT "NO DIS
     K IN THE DRIVE"
11320  PRINT "DOOR OF THE DRIVE U
     NIT NOT CLOSED"
11330  PRINT "DISK NOT BEEN INITI
     ALISED"
11340  PRINT "USING A 13 SECTOR D
     ISK (USE 'MUFFIN'"
11350  PRINT "FROM THE APPLE MAST
     ER DISK TO CORRECT)
11355  PRINT : PRINT "SORT OUT TH
     E PROBLEM AND THEN CONTINUE.
11360  IF JW = 1 THEN JW = 0: GOTO
      13000
11365  GOTO 14000
11400  PRINT : PRINT "THERE IS NO
     T ENOUGH ROOM ON THE DISK"
11410  PRINT "TO SAVE THE CATALOG
     UE. FIND A DISK WITH"
11420  PRINT "ENOUGH FREE SECTORS
     ON IT CALCULATED BY ABOUT"
11430  PRINT "1/8TH OF THE NUMBER
     OF FILES SORTED."
11440  PRINT : PRINT "AT SOME STA
     GE DELETE THE FILE YOU JUST"

11450  PRINT "TRIED TO SAVE FROM
     THE FULL DISK SO AS"
11455  PRINT "TO AVOID COMPLICATI
     ONS ON THAT DISK."
11457  GOTO 13000
11500  PRINT : PRINT "THERE IS AL
     READY A FILE/PROGRAM/DISPLAY
     "
11510  PRINT "BY THAT NAME ON THI
     S DISK AND IT IS"
11520  PRINT "LOCKED. EITHER RENA
     ME YOUR FILE OR"
11530  PRINT "UNLOCK THE FILE AND
     TRY ANOTHER RUN."
11540  PRINT : PRINT "RENAME OR U
     NLOCK ?(R/U)    ";
11545  GET Z$
11550  IF Z$ = "R" THEN 13000
11560  IF Z$ <  > "U" THEN 11545
11565  PRINT : PRINT  CHR$ (4);"U
     NLOCK";FI$
11570  PRINT : PRINT FI$;" IS NOW
     UNLOCKED.": GOTO 13000
11600  PRINT : PRINT "THERE HAS B
     EEN A SPELLING MISTAKE AT"
11610  PRINT "LINE NUMBER "; PEEK
     (218) +  PEEK (219) * 256
11620  PRINT : PRINT : PRINT "CHE
     CK THEN RUN PROGRAM AGAIN": END

11700  PRINT : PRINT "THAT FILE I
     S ON THE DISK BUT IT IS"
11710  PRINT "EITHER A BINARY FIL
     E OR AN APPLESOFT"
11720  PRINT "PROGRAM. YOUR FILE
     SHOULD BE A TEXT FILE."
11730  IF JW = 1 THEN 11750
11740  GOTO 14000
11750  PRINT "RENAME YOUR FILE AF
     TER PRESSING SPACE.": GOTO 1
     3000
12000  TEXT : HOME
12010  PRINT : PRINT  CHR$ (4)"CA
     TALOG"
12011  PRINT : PRINT
12012  GOSUB 10000
12020  RETURN
13000  GOSUB 10000: TEXT : HOME
13010  IF EF <  > 1 THEN  GOSUB 2
     100: GOTO 1300
13020  GOSUB 2100: GOTO 1455
14000  GOSUB 10000: RUN
```



DRAGON 32

High-resolution dump

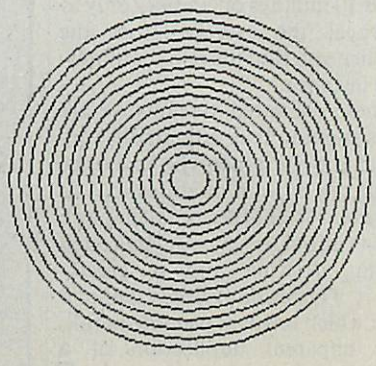
A SHORT Basic and machine-code routine which allows high-resolution screen data to be dumped to a printer, comes from R A Shackleford of Hamilton, Strathclyde.

High resolution dump.

```
1900 'BASIC SUBROUTINE AND DISASSEMBLED M/C CODE ROUTINE TO ALLOW SCREEN
1910 'DUMPING OF DRAGON 32 HIGH RESOLUTION GRAPHICS TO A TANDY LP VII.
1920 'FULL SCREEN TRANSFER TAKES ABOUT FIVE MINUTES"
1930 '
1940 ' BY   R A SHACKLEFORD
1950 '      7 CEDAR CRESCENT
1960 '      HAMILTON
1970 '      ML3 7LW
1980 '      5/NOV/1982
1990 '
2000 PRINT#-2,CHR$(18)
2010 FORI=0TO26
2020 FORJ=0TO31
2030 X=1536+224*I+J
2040 XH=INT(X/256):XL=X-256*XH
2050 POKE&H6F12,XH:POKE&H6F13,XL
2060 Z=USR0(Z)
2070 FORK=0TO7
2080 PRINT#-2,CHR$(PEEK(&H6F08+K));
2090 NEXTK,J:PRINT#-2,CHR$(13);:NEXTI:PRINT#-2,CHR$(30):RETURN
```

```
6F10   10 8E 1C DF      LDY    #1CDF
6F14   8E 6F 00         LDX    #6F00
6F17   C6 07            LDB    #07
6F19   A6 20            LDA     0,Y
6F1B   31 A8 20         LEAY   $20,Y
6F1E   A7 80            STA    ,X+
6F20   5A               DECB
6F21   26 F6            BNE    6F19
6F23   86 08            LDA    #08
6F25   10 8E 6F 08      LDY    #6F08
6F29   8E 6F 00         LDX    #6F00
6F2C   1C FE            ANDCC  #FE
6F2E   C6 07            LDB    #07
6F30   69 80            ROL    ,X+
6F32   66 20            ROR     0,Y
6F34   5A               DECB
6F35   26 F9            BNE    6F30
6F37   1A 01            ORCC   #01
6F39   66 A0            ROR    ,Y+
6F3B   4A               DECA
6F3C   26 EB            BNE    6F29
6F3E   39               RTS
```

```
30 'SAMPLE PROGRAM SHOWING OUTPUT TO PRINTER
40 '
50 DEF USR0= &H6F10
60 CLEAR200,25000
100 PMODE4,1:PCLS:SCREEN1,1
110 FORL=10 TO 90 STEP5
115 CIRCLE(128,96),L:NEXTL
120 GOSUB2000:END
```



BASIC ROUTINE

Area under curve

THE PROGRAM by R Glynn Owens for calculating the area under a normal curve is one that is very useful and can be generalised to provide integration under other curves, writes M J Campbell of Southampton. This program is more specialised but gives a similar accuracy and is very much faster. Of course, whether you wait for 0.5 seconds or five seconds for the answer matters little if you are only running the program once, but if it forms part of a larger program — a simulation for example — where it may be run hundreds of times, the time element becomes important. The algorithm is based on one given by R A Lew in the journal *Applied Statistics,* (1981) **22**, page 209.

If H(x) is the area between x and infinity and $h(t) = (2\pi)^{-\frac{1}{2}} \exp(-t^2/2)$, then H(x) is approximated by

$$0.5 - (2\pi)^{-\frac{1}{2}}(x - x^3/7)$$

for $0 \leqq x \leqq 1$, and by

$$(1 + x)h(x)/(1 + x + x^2)$$

for $x > 1$.

The area between two points a and b, $a < b$ is given by H(a) − H(b). The layout is the same as that of Owens, except that 2π is calculated as 8* ATN(1). A further increase in speed would be obtained by putting $(2\pi)^{\frac{1}{2}}$ as 2.5066283.

BASIC ROUTINE

Recursive anagram

AN EXAMPLE of a problem which, in its general form, can only be solved by using a recursive procedure comes from A M Treder of Hounslow, Middlesex. The resulting program has quite powerful applications in many problems.

The program inputs a string and prints out all the possible permutations of the characters. If the string is entered with its characters in alphabetical or numerical order then the resulting permutations will also be printed in order.

Lines 100 to 140 set up the initial variables and counters. A$(X) stores the string available at a given depth of the recursion; LE(X) stores the length of that string; CO(X) stores the count which that level as reached; and R$(X) stores the character which has been chosen from the available string during this count at this level of recursion.

Line 150 is the main program and line 200 delimits the recursive process. Line 210 increments the counter for this level. Lines 220 to 240 select and remove a character from the available string before storing that as the available string for the next level.

Line 250 stores the current counter, adjusts X for the next recursive step and proceeds to it. Line 260 is only reached after

(listing continued from page 171)

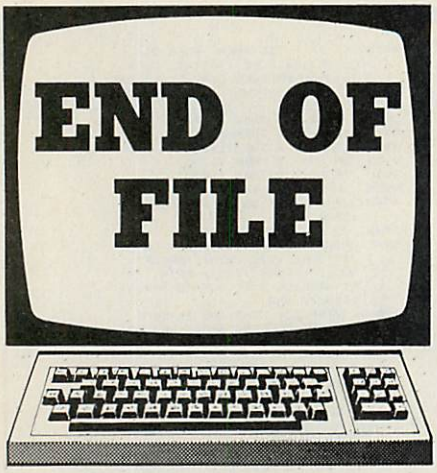
```
1810  NEXT
1820 X9 =  FRE (0)
1822  HOME : PRINT : PRINT EN" FI
     LES READ SO FAR": PRINT
1830  PRINT : PRINT "ANOTHER DISK
     TO DO ?(Y/N)":
1840  GET AN$: PRINT AN$: IF AN$ =
     "N" THEN  RETURN
1850  IF AN$ <  > "Y" THEN 1830
1852  VTAB 5: PRINT "
                                   "
1860  PRINT "FREE MEMORY = ";X9
1870  PRINT : PRINT "(LAST DISK R
     EF. WAS ";DN$" )"
1880  PRINT : PRINT "PUT NEXT DIS
     K IN,ENTER ITS I.D."
1890  PRINT : INPUT "(ONLY 4 CHAR
     S. REMEMBER!";DN$
1900  IF  LEN (DN$) < 4 THEN DN$ =
     DN$ + " ": GOTO 1900
1910  IF  LEN (DN$) > 4 THEN 1890

1920  PRINT : FLASH : PRINT " WOR
     KING.....PLEASE WAIT ": NORMAL
     : PRINT
1930  GOTO 1480
1940  REM  *** DISK READ SUBROUTI
     N AND PARAMETER TABLE ***
1950  RESTORE
1960  FOR X = 0 TO 29: READ Y: POKE
     AD + X,Y: NEXT : RETURN
1970  DATA 169,3,160,9,32,217,3,9
     6,0,1,96,1,0,17,15,26,3,196,
     134,0,0,1,0,0,96,1,0,1,239,2
     16
1980  REM  *** ERROR CHECKING ROU
     TINE ***
1990  REM  *** RETURNS ERROR CODE
      AS PAGE 97 OF DOS MANUAL (I
     BSTAT) ***
2000  REM  *** IN DECIMAL, NOT HE
     X '!' ***
2010  IF  PEEK (IO + 13) = 0 THEN
     EF = FA: RETURN
2020 EF = TR: RETURN
2030  PRINT : CALL  - 1052: CALL
     - 1052
2040  PRINT "ERROR NO. "; PEEK (I
     O + 13);" TRACK ";NT;" SECTO
     R ";NS
2050  PRINT : PRINT "YOU CAN TRY
     SAME DISK AGAIN OR PUT IN A"

2060  PRINT : PRINT "FRESH DISK W
     ITH A NEW I.D."
2070  PRINT : PRINT : PRINT "PRES
     S SPACE TO CONTINUE...";
2080  GET AN$: IF AN$ <  > " " THEN
     2080
2090  GOTO 1820
2100  TEXT : HOME
2110  PRINT : PRINT "SAVE TO DISK
     ? (Y/N)"
2120  GET AN$: IF AN$ = "N" THEN
      HOME : PRINT "'BYE FOR NOW
     THEN": RETURN
2130  IF AN$ <  > "Y" THEN 2120
2140 GM = 1:JW = 1
2150 D$ =  CHR$ (4)
2160  PRINT : PRINT "TYPE IN THE
     NAME YOU WANT THIS FILE": PRINT
     "TO HAVE      ": INPUT FI$
2170  PRINT : PRINT D$;"OPEN";FI$

2180  PRINT : PRINT D$"DELETE";FI
     $
2190  PRINT : PRINT D$"OPEN";FI$
2200  PRINT : PRINT D$;"WRITE";FI
     $
2210  PRINT EN
2220  FOR K = 1 TO EN: PRINT NA$(
     K): NEXT
2230  PRINT : PRINT D$;"CLOSE";FI
     $
2240  PRINT : PRINT D$;"LOCK";FI$

2250  TEXT : HOME
2260  PRINT  CHR$ (7) CHR$ (7): PRINT
     : PRINT "FINISHED": RETURN
```

(continued from page 171)

Brundell, Norfolk. Since then enhanced versions based on this original have been sent in, with the intention of improving the sort — which, as Mr Hourd confessed at the time, was atrocious — and providing a hard-copy back-up to disc in case of printer failure during the final printing stage. It is silly to spend 10 minutes on a utility only to have to repeat the exercise from the beginning when you find the paper was misaligned, for instance.

One of these enhanced versions we are printing this month. It is admittedly very long, and not easy for those who keyed the original to merely type in modifications to what they have. Mr G Miles of Auchinleck Academy has provided a very thorough error-checking routine and a greatly enhanced sort. The resulting utility is a solid usable result which is worth printing in full, despite the apparent duplication of a previous submission.

```
2270  TEXT : HOME : PRINT : PRINT
     "ANOTHER RUN ?(Y/N)"
2280  GET Z$: IF Z$ = "N" THEN  RETURN


2290  IF Z$ <  > "Y" THEN 2280
2300  RUN
2310 ZC = 0:ZS = 0:ZA = 1:ZN = BN
2320  IF 2 > ZA > ZN THEN 2350
2330 ZA = ZA + 1
2340  GOTO 2320
2350 ZF = 2  ZA - 1
2360 ZF =  INT (ZF / 2)
2370  IF ZF = 0 THEN  RETURN
2380 ZD = ZN - ZF
2390 ZB = 1
2400 ZA = ZB
2410 ZE = ZA + ZF
2420 ZC = ZC + 1
2430  IF NA$(ZA) > NA$(ZE) THEN 2
     470
2440 ZB = ZB + 1
2450  IF ZB > ZD THEN 2360
2460  GOTO 2400
2470 ZS = ZS + 1
2480 ZT$ = NA$(ZA):NA$(ZA) = NA$(
     ZE):NA$(ZE) = ZT$
2490 ZA = ZA - ZF
2500  IF ZA < 1 THEN 2440
2510  GOTO 2410
4000  GOSUB 4340
4010  PRINT : PRINT  CHR$ (4)"OPE
     N"FI$
4020  PRINT : PRINT  CHR$ (4)"REA
     D"FI$
4030  INPUT N
4040  DIM N$(N)
4050  FOR K = 1 TO N
4060  INPUT N$(K): NEXT
4070  PRINT : PRINT  CHR$ (4)"CLO
     SE"FI$
4080  TEXT : HOME : PRINT  CHR$ (
     7) CHR$ (7)
4090  PRINT : PRINT "HARD COPY ?
     (Y/N)"
4100  GET Z$: IF Z$ = "Y" THEN 42
     20
4110  IF Z$ <  > "N" THEN 4100
4120  TEXT : HOME : PRINT CH$
4130  PRINT
4140  POKE 34,2
4150  FOR K = 1 TO N
4160  PRINT  LEFT$ (N$(K),1); SPC(
     2); MID$ (N$(K),2,20);
4170  PRINT  SPC( 2); MID$ (N$(K)
     ,22,3); SPC( 2);"DISK "; RIGHT$
     (N$(K),4)
4180  IF (K / 18) =  INT (K / 18)
     THEN  GOSUB 4310
4190  NEXT
4200  POKE 34,0
4210  GOTO 4510
4220  PRINT : PRINT  CHR$ (4)"PRE
     1"
4230  PRINT : PRINT  SPC( 10);CH$
     : SPC( 6);"PAGE 1": PRINT : PRINT


4240  FOR K = 1 TO N
4250  PRINT  SPC( 15); LEFT$ (N$(
     K),1); SPC( 2); MID$ (N$(K),
     2,20);
4260  PRINT  SPC( 2); MID$ (N$(K)
     ,22,3); SPC( 2);"DISK "; RIGHT$
     (N$(K),4)
4270  IF K / 55 =  INT (K / 55) THEN
      PRINT  CHR$ (12): PRINT : PRINT
     : PRINT  SPC( 15);CH$; SPC(
     6);"PAGE "; INT (K / 55) + 1
     : PRINT : PRINT
4280  NEXT
4290  PRINT : PRINT  CHR$ (4)"PRE
     .O"
4300  GOTO 4510
4310  INVERSE : PRINT : PRINT : PRINT
     "PRESS SPACE FOR THE REST";:
     NORMAL
4320  GET Z$: IF Z$ <  > " " THEN
     4320
4330  HOME : RETURN
4340  TEXT : HOME
4350  PRINT : PRINT  SPC( 5);: INVERSE

     : PRINT " MASTER CATALOGUE F
     ILE READER ": NORMAL
4360  VTAB 5: HTAB 2: PRINT "IS D
     ATE REQUIRED ?(Y/N)"
4370  GET Z$: IF Z$ = "N" THEN MT
     $ = "":YN$ = "": GOTO 4430
4380  IF Z$ <  > "Y" THEN 4370
4390  VTAB 5: HTAB 2: PRINT "ENTE
     R MONTH AS WORD       ": INPUT
     MT$
4400  IF MT$ = "" THEN 4390
4410  VTAB 7: HTAB 2: PRINT "ENTE
     R YEAR (EG. 1982)": INPUT YN
     $
4420  IF YN$ = "" THEN 4410
4430  PRINT : PRINT "TYPE IN A HE
     ADING THEN PRESS RETURN"
4440  INPUT CH$
4450  IF CH$ = "" THEN CH$ = "MAS
     TER CATALOGUE"
4460 CH$ = CH$ + "   " + MT$ + "
     " + YN$
4470  TEXT : HOME : PRINT : PRINT
     "ENTER NAME OF FILE TO BE RE
     AD": INPUT FI$
4480  IF FI$ = "" THEN 4470
4485 JW = 0
4490  TEXT : HOME : FLASH : PRINT
     : PRINT " READING ";FI$;" "
4500  NORMAL : RETURN
4510  PRINT : PRINT "READ ANOTHER
     FILE ? (Y/N)"
4520  GET Z$: IF Z$ = "N" THEN  RUN

4530  IF Z$ <  > "Y" THEN 4520
4540  CLEAR : GOTO 4000
9900  REM *** ERROR MESSAGES ***
9902  TEXT : HOME : PRINT  CHR$ (
     7) CHR$ (7)
9905 ER =  PEEK (222)
9910  IF ER = 255 THEN  POKE 216,
     0: TEXT : HOME : PRINT  CHR$
     (7)"YOU PRESSED CTRL-C": PRINT
     : PRINT : PRINT "'BYE FOR NO
     W": END
9915  IF ER = 4 THEN 11100
9917  IF ER = 5 THEN 11150
9920  IF ER = 6 THEN 11200
9925  IF ER = 8 THEN 11300
9930  IF ER = 9 THEN 11400
9935  IF ER = 10 THEN 11500
9940  IF ER = 11 OR ER = 16 THEN
     11600
9942  IF ER = 13 THEN 11700
9945  POKE - 16303,0: PRINT  CHR$
     (7) CHR$ (7): PRINT "ERROR N
     O....."; PEEK (222): PRINT "G
     ET HELP OR TYPE RUN TO TRY A
     GAIN.": END
10000  VTAB 23: HTAB 10: INVERSE
     : PRINT " PRESS SPACE BAR TO
     GO ON "
10005  NORMAL
10010 Z =  PEEK ( - 16384) - 128
10020  IF Z = 32 THEN  POKE  - 16
     368,0: RETURN
10030  GOTO 10010
11000  REM ***** ERROR HANDLING R
     OUTINES ***
11100  PRINT : PRINT "YOU CANNOT
     RECORD ON THIS DISK' IT IS"
11110  PRINT "WRITE PROTECTED. RE
     'MOVE THE TAPE ON THE"
11120  PRINT "RIGHT HAND SIDE OF
     THE DISK THEN TRY"
11130  PRINT "AGAIN."
11140  GOTO 13000
11150  PRINT : PRINT "THAT FILE D
     IDN'T EXIST ON THIS DISK,OR"
     : PRINT "ELSE IT DIDN'T HAVE
     ANY INFORMATION IN"
11155  PRINT "IT.": PRINT : PRINT
     "TRY AGAIN.": GOTO 14000
11200  PRINT : PRINT "THERE'S NO
     FILE/PROGRAM/PICTURE/DISPLAY
     "
11210  PRINT "OF THAT NAME ON THI
     S DISK. EITHER CHECK"
11220  PRINT "YOUR SPELLING OR TR
     Y ANOTHER DISK."
11230  GOTO 13000
11300  PRINT : PRINT "THERE'S AN
     INPUT/OUTPUT ERROR (I/O):"
11310  PRINT "THE COMMON CAUSES O
     F THIS ARE:-": PRINT "NO DIS
     K IN THE DRIVE"
11320  PRINT "DOOR OF THE DRIVE U
     NIT NOT CLOSED"
11330  PRINT "DISK NOT BEEN INITI
     ALISED"
11340  PRINT "USING A 13 SECTOR D
     ISK (USE 'MUFFIN'"
11350  PRINT "FROM THE APPLE MAST
     ER DISK TO CORRECT)
11355  PRINT : PRINT "SORT OUT TH
     E PROBLEM AND THEN CONTINUE.
11360  IF JW = 1 THEN JW = 0: GOTO
      13000
11365  GOTO 14000
11400  PRINT : PRINT "THERE IS NO
     T ENOUGH ROOM ON THE DISK"
11410  PRINT "TO SAVE THE CATALOG
     UE. FIND A DISK WITH"
11420  PRINT "ENOUGH FREE SECTORS
     ON IT CALCULATED BY ABOUT"
11430  PRINT "1/8TH OF THE NUMBER
     OF FILES SORTED."
11440  PRINT : PRINT "AT SOME STA
     GE DELETE THE FILE YOU JUST"

11450  PRINT "TRIED TO SAVE FROM
     THE FULL DISK SO AS"
11455  PRINT "TO AVOID COMPLICATI
     ONS ON THAT DISK."
11457  GOTO 13000
11500  PRINT : PRINT "THERE IS AL
     READY A FILE/PROGRAM/DISPLAY
     "
11510  PRINT "BY THAT NAME ON THI
     S DISK AND IT IS"
11520  PRINT "LOCKED. EITHER RENA
     ME YOUR FILE OR"
11530  PRINT "UNLOCK THE FILE AND
      TRY ANOTHER RUN."
11540  PRINT : PRINT "RENAME OR U
     NLOCK ?(R/U)    ";
11545  GET Z$
11550  IF Z$ = "R" THEN 13000
11560  IF Z$ <  > "U" THEN 11545
11565  PRINT : PRINT  CHR$ (4);"U
     NLOCK";FI$
11570  PRINT : PRINT FI$;" IS NOW
     UNLOCKED.": GOTO 13000
11600  PRINT : PRINT "THERE HAS B
     EEN A SPELLING MISTAKE AT"
11610  PRINT "LINE NUMBER "; PEEK
     (218) +  PEEK (219) * 256
11620  PRINT : PRINT : PRINT "CHE
     CK THEN RUN PROGRAM AGAIN": END

11700  PRINT : PRINT "THAT FILE I
     S ON THE DISK BUT IT IS"
11710  PRINT "EITHER A BINARY FIL
     E OR AN APPLESOFT"
11720  PRINT "PROGRAM. YOUR FILE
     SHOULD BE A TEXT FILE."
11730  IF JW = 1 THEN 11750
11740  GOTO 14000
11750  PRINT "RENAME YOUR FILE AF
     TER PRESSING SPACE.": GOTO 1
     3000
12000  TEXT : HOME
12010  PRINT : PRINT  CHR$ (4)"CA
     TALOG"
12011  PRINT : PRINT
12012  GOSUB 10000
12020  RETURN
13000  GOSUB 10000: TEXT : HOME
13010  IF EF <  > 1 THEN  GOSUB 2
     100: GOTO 1300
13020  GOSUB 2100: GOTO 1455
14000  GOSUB 10000: RUN
```



DRAGON 32

High-resolution dump

A SHORT Basic and machine-code routine which allows high-resolution screen data to be dumped to a printer, comes from R A Shackleford of Hamilton, Strathclyde.

BASIC ROUTINE

Area under curve

THE PROGRAM by R Glynn Owens for calculating the area under a normal curve is one that is very useful and can be generalised to provide integration under other curves, writes M J Campbell of Southampton. This program is more specialised but gives a similar accuracy and is very much faster. Of course, whether you wait for 0.5 seconds or five seconds for the answer matters little if you are only running the program once, but if it forms part of a larger program — a simulation for example — where it may be run hundreds of times, the time element becomes important. The algorithm is based on one given by R A Lew in the journal *Applied Statistics,* (1981) **22**, page 209.

If H(x) is the area between x and infinity and $h(t) = (2\pi)^{-\frac{1}{2}} \exp(-t^2/2)$, then H(x) is approximated by

$$0.5 - (2\pi)^{-\frac{1}{2}}(x - x^3/7)$$

for $0 \leqq x \leqq 1$, and by

$$(1 + x)h(x)/(1 + x + x^2)$$

for $x > 1$.

The area between two points a and b, $a < b$ is given by H(a) − H(b). The layout is the same as that of Owens, except that 2π is calculated as 8* ATN(1). A further increase in speed would be obtained by putting $(2\pi)^{\frac{1}{2}}$ as 2.5066283.

BASIC ROUTINE

Recursive anagram

AN EXAMPLE of a problem which, in its general form, can only be solved by using a recursive procedure comes from A M Treder of Hounslow, Middlesex. The resulting program has quite powerful applications in many problems.

The program inputs a string and prints out all the possible permutations of the characters. If the string is entered with its characters in alphabetical or numerical order then the resulting permutations will also be printed in order.

Lines 100 to 140 set up the initial variables and counters. A$(X) stores the string available at a given depth of the recursion; LE(X) stores the length of that string; CO(X) stores the count which that level as reached; and R$(X) stores the character which has been chosen from the available string during this count at this level of recursion.

Line 150 is the main program and line 200 delimits the recursive process. Line 210 increments the counter for this level. Lines 220 to 240 select and remove a character from the available string before storing that as the available string for the next level.

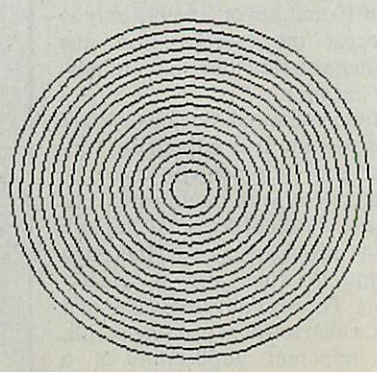
Line 250 stores the current counter, adjusts X for the next recursive step and proceeds to it. Line 260 is only reached after

High resolution dump.

```
1900 'BASIC SUBROUTINE AND DISASSEMBLED M/C CODE ROUTINE TO ALLOW SCREEN
1910 'DUMPING OF DRAGON 32 HIGH RESOLUTION GRAPHICS TO A TANDY LP VII.
1920 'FULL SCREEN TRANSFER TAKES ABOUT FIVE MINUTES"
1930 '
1940 '  BY   R A SHACKLEFORD
1950 '       7 CEDAR CRESCENT
1960 '       HAMILTON
1970 '       ML3 7LW
1980 '       5/NOV/1982
1990 '
2000 PRINT#-2,CHR$(18)
2010 FORI=0TO26
2020 FORJ=0TO31
2030 X=1536+224*I+J
2040 XH=INT(X/256):XL=X-256*XH
2050 POKE&H6F12,XH:POKE&H6F13,XL
2060 Z=USR0(Z)
2070 FORK=0TO7
2080 PRINT#-2,CHR$(PEEK(&H6F08+K));
2090 NEXTK,J:PRINT#-2,CHR$(13);:NEXTI:PRINT#-2,CHR$(30):RETURN
```

```
6F10   10 8E 1C DF     LDY    #1CDF
6F14   8E 6F 00        LDX    #6F00
6F17   C6 07           LDB    #07
6F19   A6 20           LDA     0,Y
6F1B   31 A8 20        LEAY   $20,Y
6F1E   A7 80           STA    ,X+
6F20   5A              DECB
6F21   26 F6           BNE    6F19
6F23   86 08           LDA    #08
6F25   10 8E 6F 08     LDY    #6F08
6F29   8E 6F 00        LDX    #6F00
6F2C   1C FE           ANDCC  #FE
6F2E   C6 07           LDB    #07
6F30   69 80           ROL    ,X+
6F32   66 20           ROR     0,Y
6F34   5A              DECB
6F35   26 F9           BNE    6F30
6F37   1A 01           ORCC   #01
6F39   66 A0           ROR    ,Y+
6F3B   4A              DECA
6F3C   26 EB           BNE    6F29
6F3E   39              RTS
```

```
30 'SAMPLE PROGRAM SHOWING OUTPUT TO PRINTER
40 '
50 DEF USR0= &H6F10
60 CLEAR200,25000
100 PMODE4,1:PCLS:SCREEN1,1
110 FORL=10 TO 90 STEP5
115 CIRCLE(128,96),L:NEXTL
120 GOSUB2000:END
```



a Return from line 330. Line 270 checks the counter and readjusts it if the end of the string has been reached, in which case it returns to the next higher level. Otherwise line 280 takes the program to where it chooses the next available character.

Lines 290 to 330 simply concatenate the chosen characters and print the resulting permutation. Line 330 then returns to line 260 to choose the next available character.

I have found that Clear 100 is sufficient space for a string of 10 characters. Obviously more can be cleared for longer strings. The program can be immediately rewritten into single-statement lines with the exception of line 270 which would require an extra If statement to return.

As an example of a non-crossword application consider line 320 replaced by Gosub 400 and include

400 for I = 1 to Y-1
410 X$ = LEFT$(R$,I): Y$ = RIGHT$(R$,Y-1)
420 X = VAL(X$): Y = VAL(Y$)
430 NEXT I
440 RETURN

The input to A$ must now be a purely numeric one. The program now yields in X and Y all possible pairs of numbers that can be formed by using all the digits given once and only once.

UK 101

Save/Load routine

THE PROGRAM by N V Davies of Haverfordwest, Dyfed, enables named Basic programs complete with all variables to be saved on cassette and then searched for and reloaded with auto-run. The program makes use of the 6850 ACIA's ability to generate a parity bit during the save operation and then check this bit during load to test for loading errors.

The program is located to suit an 8K machine and should be loaded from $1EDO to $1FFF. Basic's Memory Size should be answered by 7888 to give 7,119 bytes free. For machines with more than 8K of RAM the program may be relocated to the top of available RAM and Memory Size answered appropriately to protect the machine-code program.

The Pokes will then have to be changed to

(continued on next page)

Area under curve.

```
100 PRINT CHR$(147)
200 PRINT"THIS PROGRAM CALCULATES THE AREA UNDER THE NORMAL CURVE BETWEEN "
300 PRINT"ANY TWO X COORDINATES, USING AN APPROXIMATION DUE TO LEW "
400 PRINT"PLEASE GIVE YOUR TWO X COORDINATES NOW,TYPING RETURN AFTER EACH ONE"
500 INPUT"X(1)";A:INPUT"X(2)";B:
600 X=A
700 GOSUB 10000
800 R=P: X=B
900 GOSUB 10000
950 AR=INT(1000*(R-P))/1000
1000 PRINT CHR$(135),"THE AREA ENCLOSED IS ";AR " OF THE TOTAL"
1100 STOP
10000 TP=8*ATN(1):C=SQR(TP)
10050 Y=ABS(X)
10100 IFY<=1 GOTO20000
10200 P=(1+Y)*EXP(-Y*Y/2)/(C*(1+Y+Y*Y))
10250 GOTO 20100
20000 P=0.5-(Y-Y*Y*Y/7)/C
20100 IF X<0 THENP=1-P
20200 RETURN
READY.
```

Save/Load routine.

```
                ;UK101 PARITY CHECK BASIC SA VE/LOAD
                ;N.V.DAVIES SEPT. 1981
                ES=$A187
                ESH=ES/256
                ESM=ESH*256
                ESL=ES-ESM
                ADDR=$00F0
                SAVEF=$0205
                LOADF=$0203
1EDO            *=$1EDO
1EDO 20A51F     ENTSVE JSR INITP INIT ACIA EVEN PARITY
1ED3 20F7FF            JSR $FFF7 SET SAVE FLAG
1ED6 206CAB            JSR $AB6C OUTPUT CR/LF
1ED9 20BC00     LSTNME JSR $BC   GET NAME
1EDC F024              BEQ SNERR
1EDE 20EEFF            JSR $FFEE AND OUTPUT TO CASS.
1EE1 C95D              CMP #$5D  CHECK FOR END
1EE3 D0F4              BNE LSTNME MORE
1EE5 206CAB            JSR $AB6C OUTPUT CR/LF
1EE8 20051F            JSR LSTART SET UP PROG START-VAR END
1EEB 202F1F            JSR SAVE SAVE POINTERS, PROG & VARIABLES
1EEE 201A1F            JSR LSTR SET UP STRING START-MEM END
1EF1 A000              LDY #0
1EF3 203A1F            JSR SAVE2 SAVE STRINGS
1EF6 206CAB            JSR $AB6C OUTPUT CR/LF
1EF9 8C0502            STY SAVEF CLEAR SAVE FLAG
1EFC 20E91F     RESET  JSR INITN RESET ACIA
1EFF 4CBC00            JMP $00BC INCR MEM SCAN PTR & RTS TO BASIC
1F02 4C0CAC     SNERR  JMP $AC0C SN ERROR
1F05 A47A       LSTART LDY $7A
1F07 A679              LDX $79
1F09 D001              BNE LS2
1F0B 88                DEY
1F0C CA         LS2    DEX
1F0D 86F0              STX ADDR
1F0F 84F1              STY ADDR+1
1F11 A57F              LDA $7F
1F13 A480              LDY $80
1F15 85F2              STA ADDR+2
1F17 84F3              STY ADDR+3
1F19 60                RTS
1F1A A482       LSTR   LDY $82
1F1C A581              LDA $81
1F1E 85F0              STA ADDR
1F20 84F1              STY ADDR+1
1F22 A486              LDY $86
```

(listing continued on next page)

Recursive anagram.

```
10 REM*************************************
20 REM Recursive Anagram Routine  *
30 REM*************************************
40 REM
50 REM A. M. TREDER
60 REM
70 REM
100 CLEAR 100: PRINT CHR$(12)
110 INPUT A$: X=LEN(A$): Y=X
120 DIM A$(X),LE(X),CO(X),R$(X)
130 A$(X)=A$
140 FORI=1 TO X: LE(I)=I: NEXT I
150 GOSUB 200: END
160 REM
170 REM
180 REM Recursive Subroutine
190 REM
200 IF X=0 THEN 290
210 A=CO(X)+1
220 A$(X-1)=LEFT$(A$(X),A-1)
230 A$(X-1)=A$(X-1)+RIGHT$(A$(X),LE(X)-A)
240 R$(X)=MID$(A$(X),A,1)
250 CO(X)=A: X=X-1: GOSUB 200
260 X=X+1: A=CO(X)
270 IF A=LE(X) THEN CO(X)=0: RETURN
280 GOTO 210
290 R$="": FOR I=Y TO 1 STEP -1
300 R$=R$+R$(I)
310 NEXT I
320 PRINT R$
330 RETURN
```

(continued from previous page)

suit the new program location. When loaded at the location shown the entry point for the Save routine is at $1EDO, 7888 decimal, and the Load routine is at $1F45, 8019 decimal.

To save a Basic program start the cassette and enter:

```
POKE11,208:POKE12:30:X = USR(X):[NAM-
E]
```

Name may be any number of characters which will fit the Basic line but must be enclosed in square brackets. To search cassette and load program enter:

```
POKE11,69:POKE12,31:X = USR(X):[NAME]
```

The cassette should then be started, and when Name is located this will be displayed. The program which follows is then loaded and run. If a parity error is detected, the word Error will be displayed. The cassette should then be rewound past the start of the program and a further attempt made at loading.

The first line of all programs must be arranged so that any following lines which dimension arrays or perform any other functions which would destroy the data loaded are skipped. Basic programs are saved in the form: Program "Name", Basic's memory and variable-table pointers from $0079 to $0086, contents of program and variable table RAM, contents of string-store RAM. Reloading is simply a reverse of this procedure.

Because the program is saved as a memory dump rather than lines of text, and is not displayed on the screen, no nulls are required and saving and reloading take less than half the time of the normal List-type Save. The speed at which programs may be saved is limited only by the cassette interface and recorder. With a high-speed interface and high-quality recorder, speeds up to 9,600 baud are possible.

No monitor subroutines, except those called via the indirect vectors, are used so the program should run with all monitors.

DRAGON 32

Simon

THIS PROGRAM by D Hojoff of Stanmore, Middlesex runs on a Dragon 32 home computer with standard 32K RAM. It uses 1.7K of memory. Four boxes are displayed on the screen and numbered 1 to 4. After a brief musical interlude a musical note is given, and at the same time one of the boxes flashes. You have to copy the sequence by pressing the keys 1 to 4 corresponding to the boxes that have flashed.

The sequence gradually becomes longer until a mistake is made, and a raspberry is emitted. You are given a grading at the end according to your ability.

You can continue by either trying the same sequence again, or attempting a new sequence. if you take too long to type your response you also get a raspberry. The sequence goes to a maximum of 32 characters.

(continued on page 178)

(listing continued from previous page)

```
 470 1F24 A685           LDX $85
 480 1F26 D001           BNE LSTR1
 490 1F28 88             DEY
 500 1F29 CA       LSTR1 DEX
 510 1F2A 84F3           STY ADDR+3
 520 1F2C 86F2           STX ADDR+2
 530 1F2E 60             RTS
 540 1F2F A00E     SAVE  LDY #$0E SAVE BASIC'S POINTERS
 550 1F31 B97B00   LP1   LDA $78,Y
 560 1F34 20F41F         JSR CASOUT
 570 1F37 88             DEY
 580 1F38 D0F7           BNE LP1
 590 1F3A B1F0     SAVE2 LDA (ADDR),Y
 600 1F3C 20F41F         JSR CASOUT
 670 1F3F 20D41F         JSR INCAD
 680 1F42 90F6           BCC SAVE2
 690 1F44 60       BTB   RTS
 700 1F45 20A51F   ENTLD JSR INITP INIT ACIA EVEN PARITY
 710 1F4B 20F4FF         JSR $FFF4 SET LOAD FLAG
 720 1F4B 20BC00         JSR $BC
 730 1F4E C95B           CMP #$5B
 740 1F50 D0B0           BNE SNERR SN ERROR IF NO [
 750 1F52 A0FF     LOALP LDY #$FF
 760 1F54 C8       LOALP1 INY
 770 1F55 AD0302         LDA $0203
 780 1F5B F0EA           BEQ BTB ABORT IF L.F. CLEAR
 790 1F5A 20EBFF         JSR $FFEB GET INPUT
 800 1F5D D1C3           CMP ($C3),Y CMP WITH [NAME]
 810 1F5F D0F1           BNE LOALP NOT NAME-TRY AGAIN
 820 1F61 20EEFF         JSR $FFEE DISPLAY TO VDU
 830 1F64 C95D           CMP #$5D END OF NAME?
 840 1F66 D0EC           BNE LOALP1 NO-GET NEXT LETTER
 850 1F6B A00E     RFLD1 LDY #$0E
 860 1F6A 20B01F   LOAD1 JSR GETCAS
 880 1F6D C90A           CMP #$0A  END OF NULLS
 890 1F6F D0F9           BNE LOAD1 SKIP NULLS
 900 1F71 20B01F   LOADA JSR GETCAS GET BASIC'S POINTERS
 910 1F74 997B00         STA $78,Y  AND RE-LOAD
 920 1F77 88             DEY
 930 1F78 D0F7           BNE LOADA
 940 1F7A 20051F         JSR LSTART
 950 1F7D 20981F         JSR LOAD2   LOAD PROG & VARIABLES
 960 1F80 201A1F         JSR LSTR
 970 1F83 20981F         JSR LOAD2  LOAD STRINGS
 980 1F86 8C0302         STY LOADF  CLEAR LOAD FLAG
 990 1F89 20FC1E   RFLD  JSR RESET  RESET ACIA
1000 1F8C 20A7A4         JSR $A4A7  SET MEM SCAN TO PROG START
1010 1F8F A9A5           LDA #$A5
1020 1F91 48             PHA
1030 1F92 A9C1           LDA #$C1
1040 1F94 48             PHA
1050 1F95 4C8EA4         JMP $A48E   RUN BUT NO POINTER RESET
1060 1F98 A000    LOAD2  LDY #0
1070 1F9A 20B01F  LOAD3  JSR GETCAS
1080 1F9D 91F0           STA (ADDR),Y
1090 1F9F 20D41F         JSR INCAD
1100 1FA2 90F6           BCC LOAD3
1110 1FA4 60             RTS
1120 1FA5 A903    INITP  LDA #$3 SET ACIA EVEN PARITY
1130 1FA7 8D00F0         STA $F000
1140 1FAA A919           LDA #$19
1150 1FAC 8D00F0         STA $F000
1160 1FAF 60             RTS
1170 1FB0 AD00F0  GETCAS LDA $F000
1180 1FB3 4A             LSR A
1190 1FB4 90FA           BCC GETCAS
1200 1FB6 AD00F0         LDA $F000
1210 1FB9 2940           AND #$40 CHECK PARITY BIT
1220 1FBB D004           BNE ERR  ERROR IF SET
1230 1FBD AD01F0         LDA $F001
1240 1FC0 60             RTS
1250 1FC1 206CAB  ERR    JSR $AB6C DISPLAY CR/LF ERROR CR/LF
1260 1FC4 A987           LDA #ESL
1270 1FC6 A0A1           LDY #ESH
1280 1FC8 20C3AB         JSR $ABC3
1290 1FCB 206CAB         JSR $AB6C
1300 1FCE A2FE           LDX #$FE RESET STACK POINTER
1310 1FD0 9A             TXS
1320 1FD1 4C521F         JMP LOALP JMP TO REPEAT SEARCH FOR NAME
1330 1FD4 A5F1    INCAD  LDA ADDR+1 RETURN CARRY SET IF DONE
1340 1FD6 C5F3           CMP ADDR+3 OTHERWISE INCR. POINTERS
1350 1FD8 9008           BCC INCAD1
1360 1FDA D00C           BNE RINCAD
1370 1FDC A5F0           LDA ADDR
1380 1FDE C5F2           CMP ADDR+2
1390 1FE0 B006           BCS RINCAD
1400 1FE2 E6F0    INCAD1 INC ADDR
1410 1FE4 D002           BNE RINCAD
1420 1FE6 E6F1           INC ADDR+1
1430 1FE8 60      RINCAD RTS
1440 1FE9 A903    INITN  LDA #$3 RESET ACIA TO NORMAL
1450 1FEB 8D00F0         STA $F000
1460 1FEE A911           LDA #$11
1470 1FF0 8D00F0         STA $F000
1480 1FF3 60             RTS
1490 1FF4 AA      CASOUT TAX
1500 1FF5 AD00F0  CASLP  LDA $F000
1510 1FFB 4A             LSR A
1520 1FF9 4A             LSR A
1530 1FFA 90F9           BCC CASLP
1550 1FFC 8E01F0         STX $F001
1560 1FFF 60             RTS
```

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(continued from page 176)

Simon.

```
10 PLAY"O3T4L4GE,L2G,L4GE,L2G,L4AGFEDEF,L8EF,L4GC:L8CC:L4C,L3CDEF,L2G,L4GDDFED,L2C,L4,"
20 CLS:C$=""
30 PRINT@137,CHR$(49);
40 PRINT@150,CHR$(50);
50 PRINT@361,CHR$(51);
60 PRINT@374,CHR$(52);
70 G$=CHR$(143+48)+CHR$(143+48)+CHR$(143+48)
80 PRINT@104,G$;
90 PRINT@168,G$;
100 PRINT@136,CHR$(143+48);
110 PRINT@138,CHR$(143+48);
120 G$=CHR$(143+32)+CHR$(143+32)+CHR$(143+32)
130 PRINT@117,G$;
140 PRINT@149,CHR$(143+32);
150 PRINT@151,CHR$(143+32);
160 PRINT@181,G$;
170 G$=CHR$(143+16)+CHR$(143+16)+CHR$(143+16)
180 PRINT@328,G$;
190 PRINT@360,CHR$(143+16);
200 PRINT@362,CHR$(143+16);
210 PRINT@392,G$;
220 G$=CHR$(143+64)+CHR$(143+64)+CHR$(143+64)
230 PRINT@341,G$;
240 PRINT@373,CHR$(143+64);
250 PRINT@375,CHR$(143+64);
260 PRINT@405,G$;
270 FORI=1TO32:PRINT@223+I,CHR$(141);:PRINT@255+I,CHR$(139);:NEXTI
280 FORI=0TO15:PRINT@15+32*I,CHR$(139),:PRINT@16+32*I,CHR$(141);:NEXTI
290 PRINT@239,CHR$(137);:PRINT@272,CHR$(137);
300 IFC$="S"THENE=0:GOTO370
310 A$="":E=0
320 FORI=1TO32
330 B$=STR$(RND(4))
340 B$=RIGHT$(B$,1)
350 A$=A$+B$
360 NEXTI
370 FORN=1TO32
380 FORI=1TON
390 GOSUB480
400 NEXTI
410 FORI=1TON
420 GOSUB540
430 NEXTI
440 FORA=1TO1000:NEXTA
450 IFE=1THENN=32
460 NEXTN
470 GOTO610
480 B$=MID$(A$,I,1)
490 IFB$="1"THENPRINT@137,CHR$(143+48);:PLAY"C":PRINT@137,CHR$(49);:GOTO530
500 IFB$="2"THENPRINT@150,CHR$(143+32);:PLAY"E":PRINT@150,CHR$(50);:GOTO530
510 IFB$="3"THENPRINT@361,CHR$(143+16);:PLAY"G":PRINT@361,CHR$(51);:GOTO530
520 IFB$="4"THENPRINT@374,CHR$(143+64);:PLAY"B":PRINT@374,CHR$(52);
530 RETURN
540 TIMER=0
550 B$=INKEY$:IFTIMER>200THEN580
560 IFB$=""THEN550
570 IFB$=MID$(A$,I,1)THEN590
580 E=1:I=N:FORA=1TO32:SOUND85,1:NEXTA:GOTO600
590 GOSUB490
600 RETURN
610 IFI<9THENPRINT@448,"BEGINNER";:GOTO650
620 IFI<23THENPRINT@448,"AMATEUR";:GOTO650
630 IFI<32THENPRINT@448,"EXPERI";:GOTO650
640 IFI=32THENPRINT@448,"CHAMP";
650 PRINT@480,"DO YOU WANT TO CONTINUE (Y/N)?";
660 C$=INKEY$:IFC$=""THEN660
670 CLS
680 IFC$="N"THENEND
690 PRINT@32,"SAME SEQUENCE AGAIN = S"
700 PRINT@64,"PRINT THE LAST SEQUENCE = P"
710 PRINT@96,"TRY A NEW SEQUENCE = T"
720 C$=INKEY$:IFC$=""THEN720
730 IFC$="S"THENCLS:GOTO30
740 IFC$="P"THENCLS:PRINTLEFT$(A$,I-1):GOTO650
750 IFC$="T"THEN20
760 GOTO690
```

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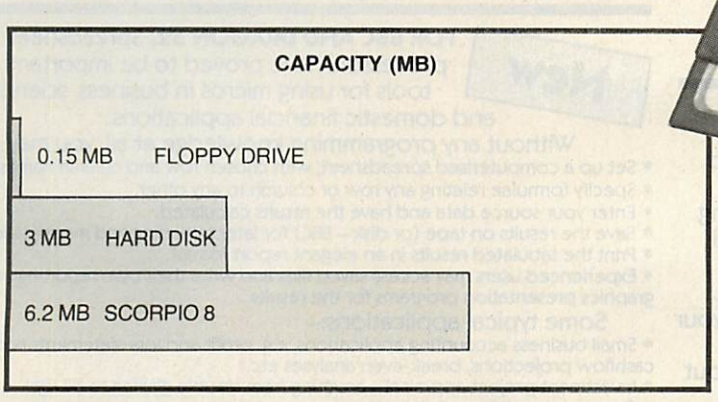

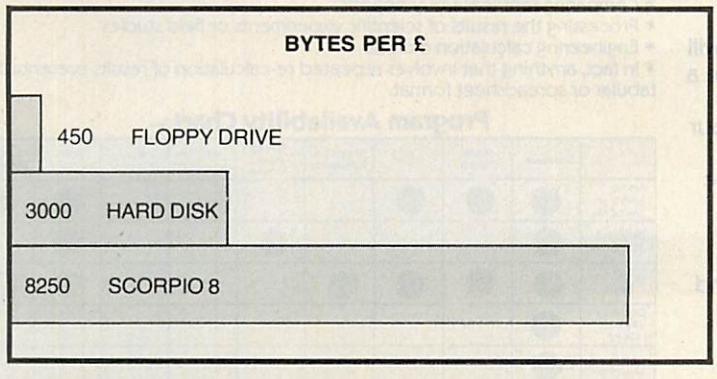

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* Engineering calculation models
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Program Availability Chart:–

	Database	Stock Control	Mailist	Invoices & Statements	Spread sheet Analysis	Cashbook Accounting	Word processor	Home Accounts	Commercial Accounts
Sinclair Spectrum 16k or 48k	●	●	●					●	●
Dragon 32k or 64k	●				●			●	
VIC20 (16k+)	●	●	●	●				●	●
Sinclair ZX81 (16k+)	●								
Grundy Newbrain	●								
Texas TI99/4A	●								
Atari 400/800 or Osborne	●								
Sharp MZ80A	●	●	●	●				●	●
Sharp MZ80K	●	●	●	●				●	●
Sharp MZ80B	●	●	●	●				●	●
BBC micro model A or B 32K	●	●	●	●	●	●	●	●	●

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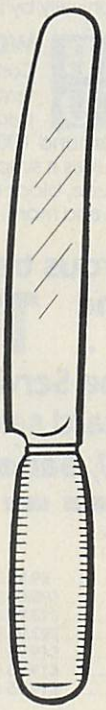

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Spectrum machine code

Bill Bennett searches for a good book on the subject — does such a thing exist?

WHAT BETTER WAY could there be of learning machine-code programming than on a Spectrum computer? It does not cost much, so if you do find mastering it too difficult then little is lost — you can always give the Spectrum to some kids. Logical deducation might lead you to think that because there are lots of books published about the Spectrum, there should be at least one good one about learning machine-code programming.

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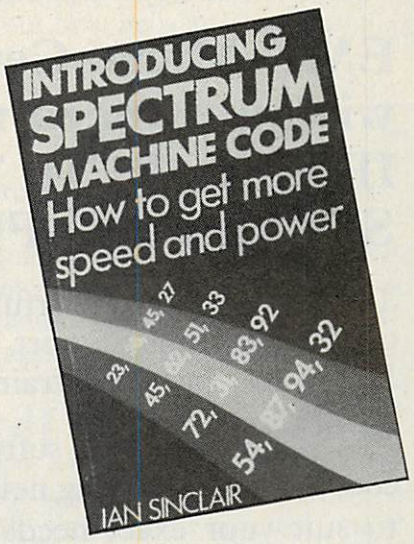

As far as the information inside is concerned it could be pure wisdom, but it is painful to look at. The book costs £7.95, but the extraordinarily high cost is warranted by the sheer amount of useful information within.

Understanding your Spectrum contains all the information an experienced machine-code programmer could need and will also be of great use to Basic programmers. It is in effect a supplement to the Sinclair manual. I cannot recommend the content too highly — it is a shame that a decent publisher has not signed Ian Logan up.

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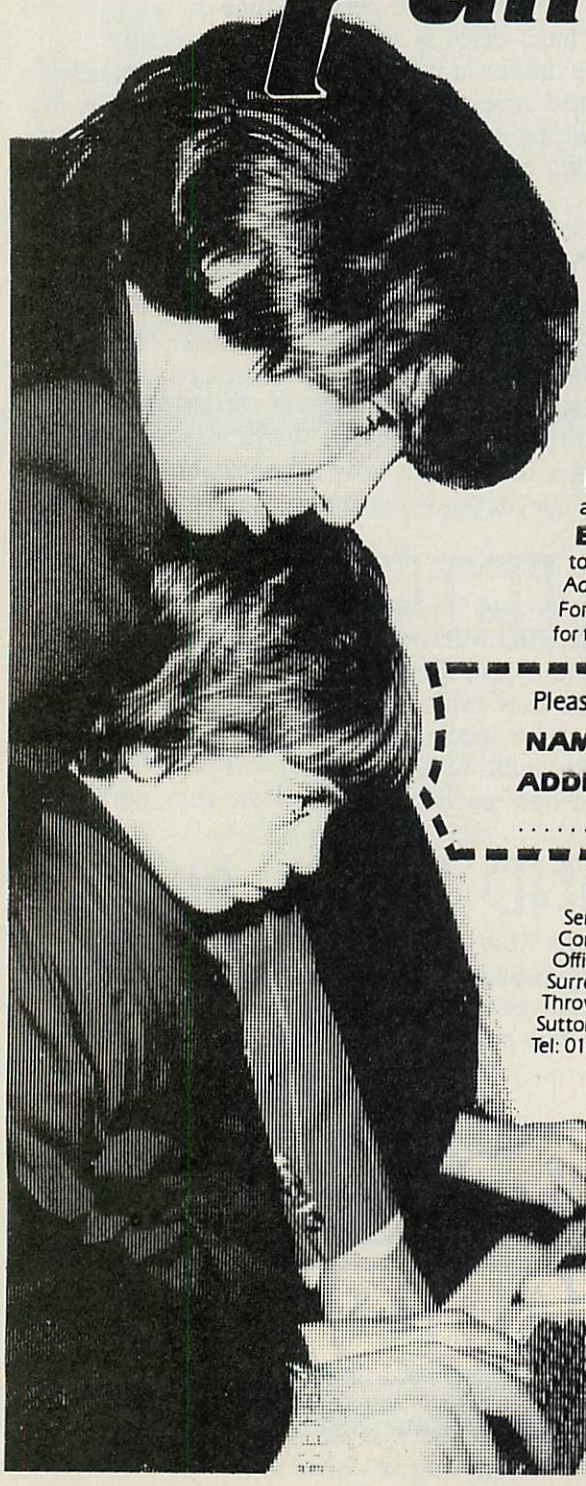

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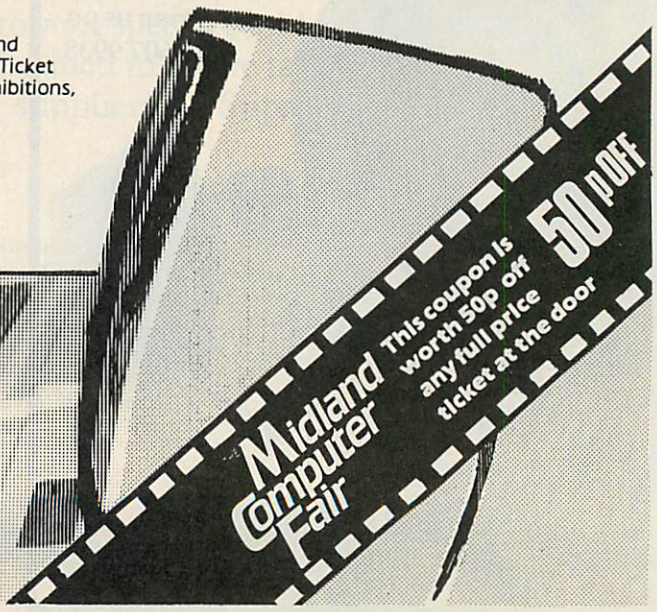

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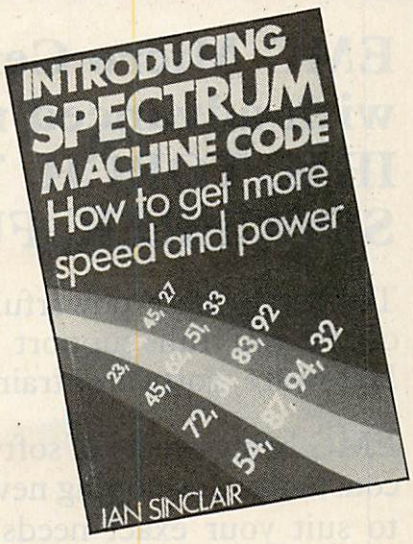

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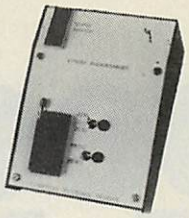

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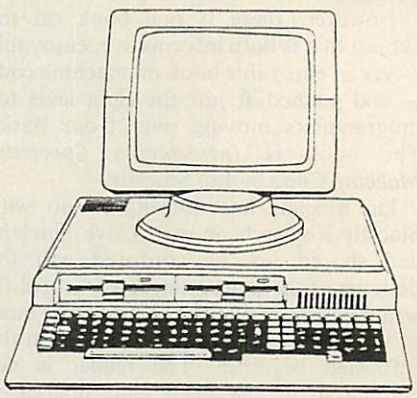

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>NEXT MONTH

>MASS STORAGE AND DATABASES

The special section in the May issue is devoted to two of the most important growth areas in microcomputing. Important developments in mass storage include microfloppies of 3 to 3.5 inches, bubble memories, and video tapes and discs. Meanwhile the performance of floppies and hard discs is increasing dramatically.

The database programs needed to store, select, sort and access large amounts of information are making a big impact on the market. We're checking out the main developments in these vital fields

>ORION RISING

A leading office-equipment supplier was confident it could sell a new micro — so it commissioned one. The result is the new 16-bit Orion desk-top micro. We interviewed the designer to find out how he went about building it, and tested the machine.

>PICTURE THIS

The BBC Microcomputer offers exceptional colour-graphics facilities, but how can the average user exploit them to the full? The answer is to use a special graphics program designed to make painting and drawing simple. We tested three new packages to see how they perform.

>AND MUCH MORE!

Plus the May issue will include special articles on programming and using microcomputers, and the usual reviews and departments including the Open File pages of programs for popular micros, news and letters.

Practical Computing

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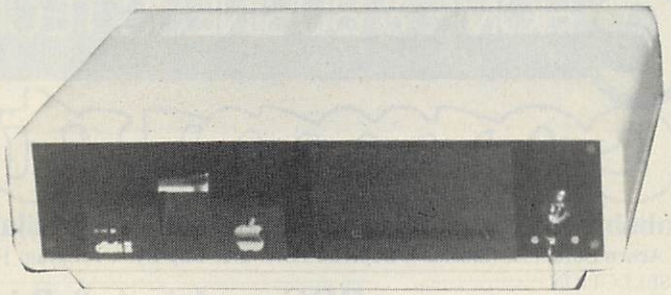

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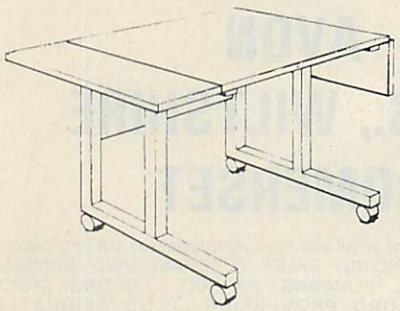

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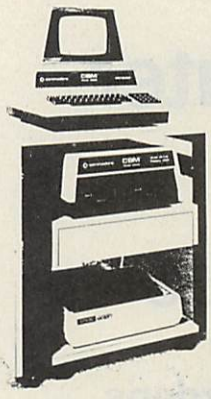

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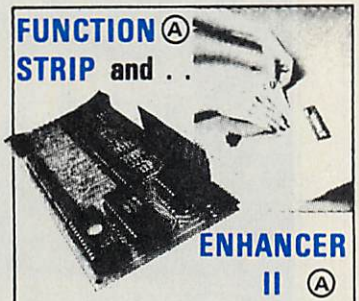

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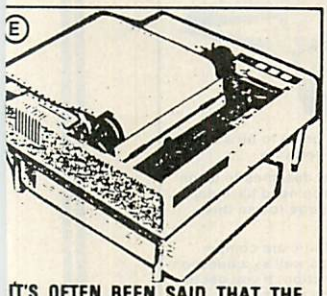

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QUICKCODE FOR DBASE-II	203	24
INFORMATION UNLIMITED		
WHATSIT (Database Management System)	80	
KLH SYSTEMS		
Spooler for CPM systems v3.0	92	8
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CPM SIM	157	
MICRO-AP		
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DATASTAR 1.101	193	33
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CALCSTAR 1.2	128	33
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The CP/M TUTOR is an interactive tutorial designed to teach you all about CP/M and your computer. You need have no previous computer experience or knowledge to use this trainer.

The tutorial will run at your own speed. There are comprehensive help messages if you get stuck, as well as a question and answer session at the end of each section. If you get the answers wrong, the computer will give you a hint.

This tutorial is invaluable for anyone who wishes to understand how to make the best use of CP/M, and thus make the most of their computer.

***HELPFUL BOOKS:**

We have a wide range of books, selected to support our comprehensive list of software. Four books which may interest you are:

- CP/M User Guide £11.10
- The CP/M Handbook with MP/M £12.10
- CP/M Primer £10.95
- Mastering CP/M £12.95

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Comart Communicator CP100	P2	EXO	A1	Micropolis Mod II	Q2	(Other CP/M)	P2
Comart Communicator CP200	P2	Gemini Galaxy I	NI	Morrow Discus	A1	Nylac Micropolis Mod II	Q2
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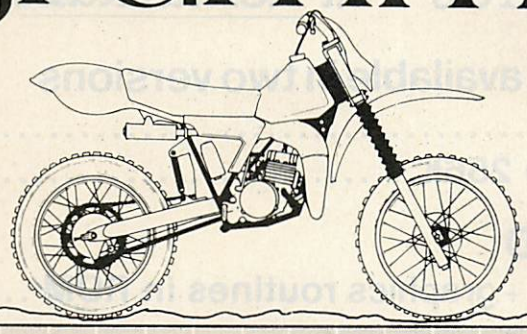
Xerox 820 5.25in	S6		
Xerox 820 8in	A1		

Performance Programming



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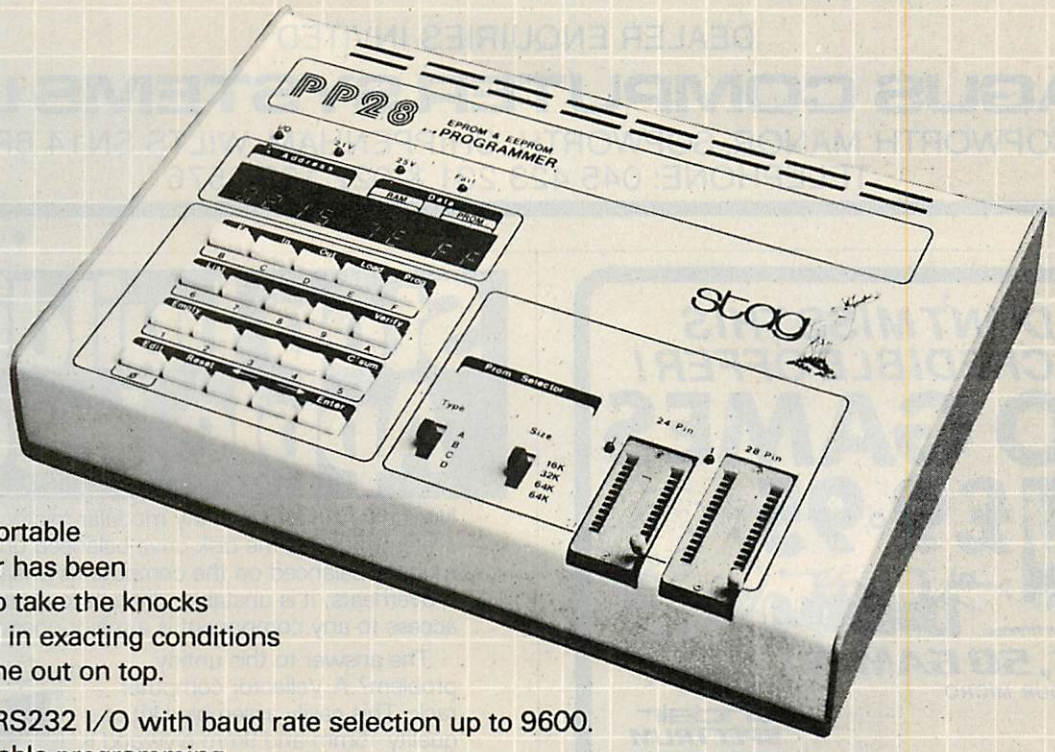

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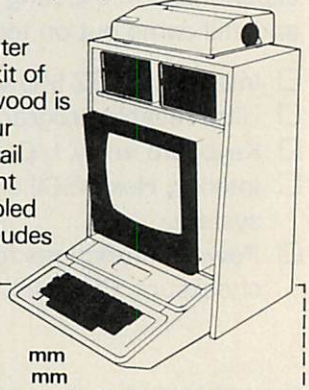

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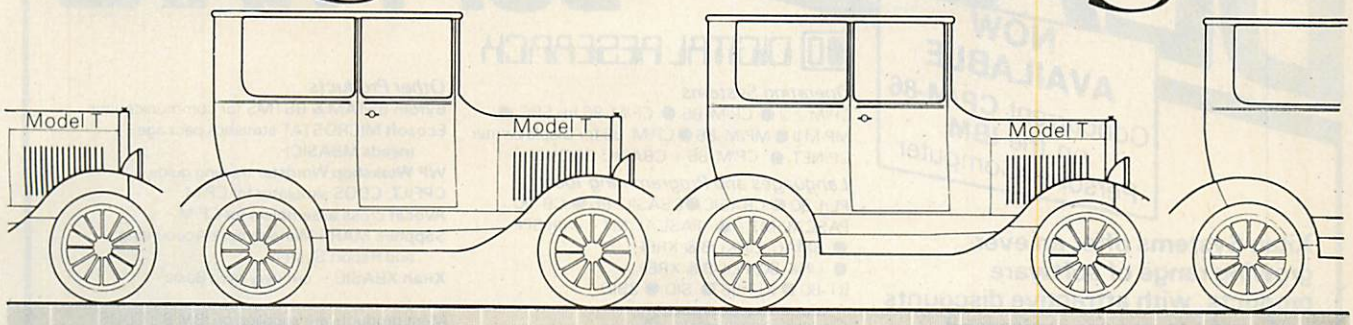

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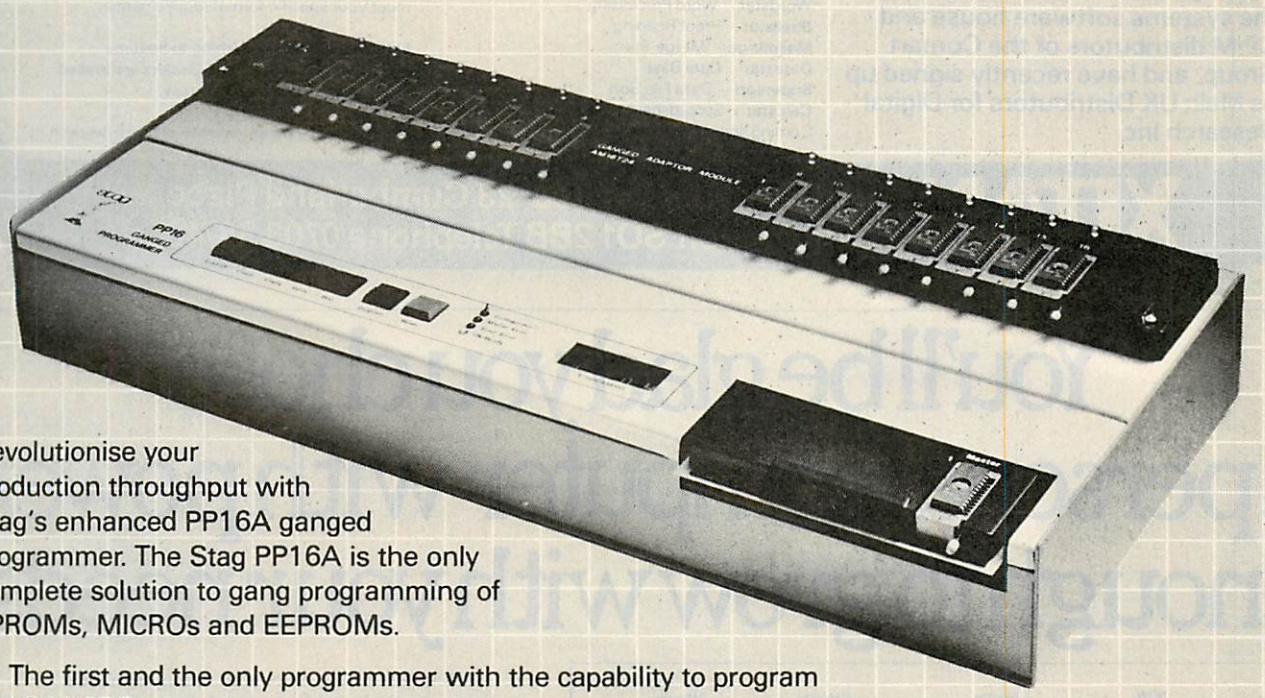

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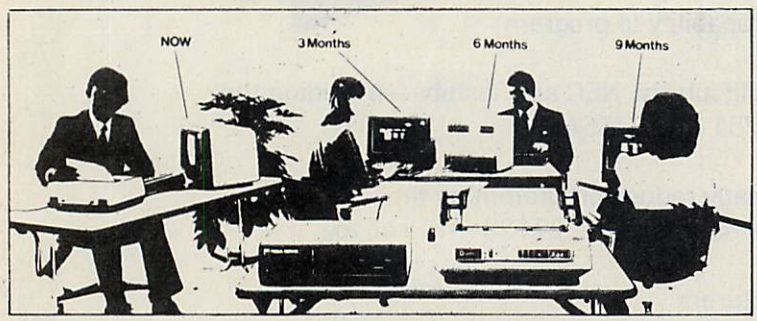

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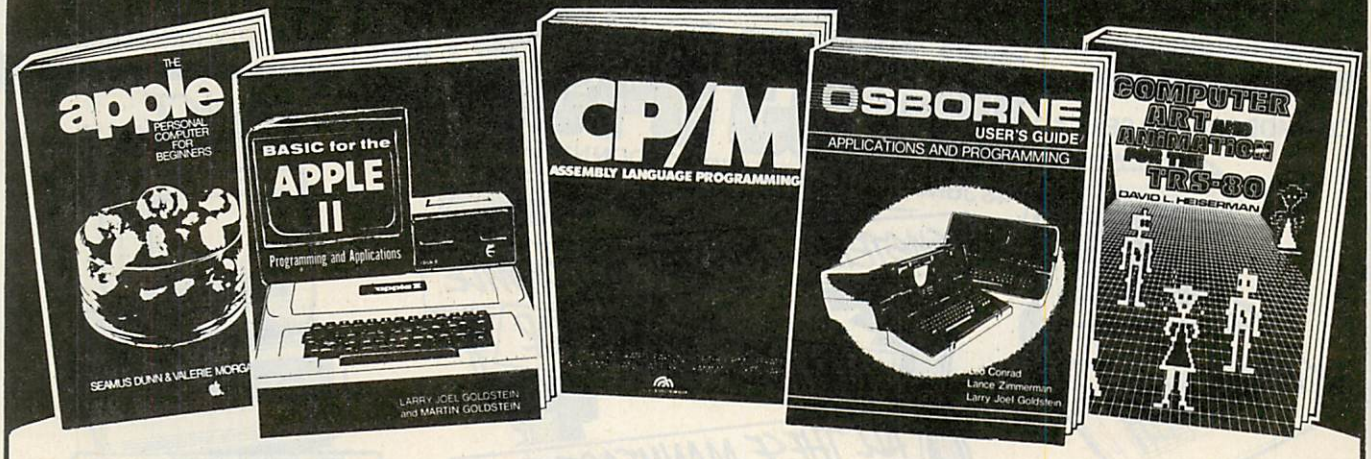

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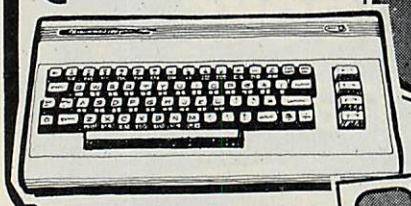

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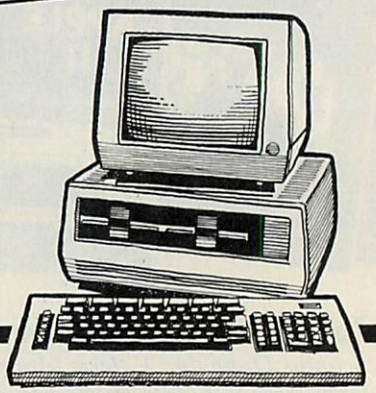

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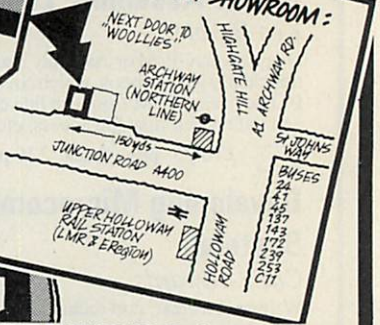

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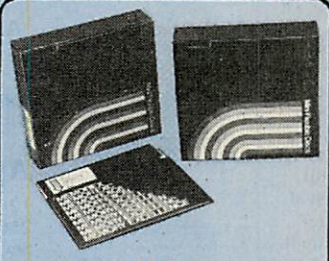

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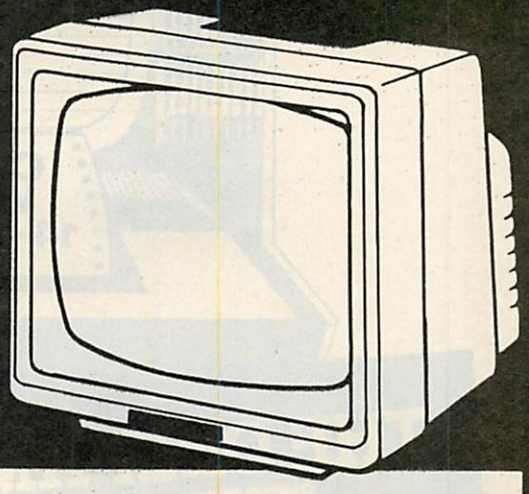

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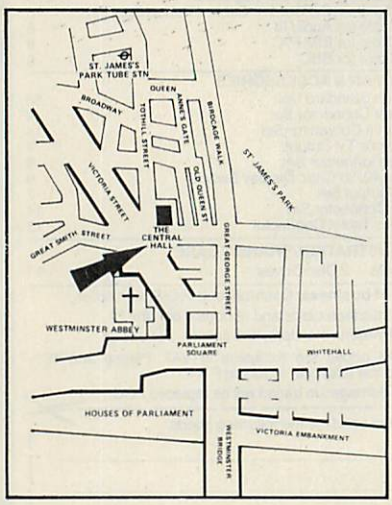

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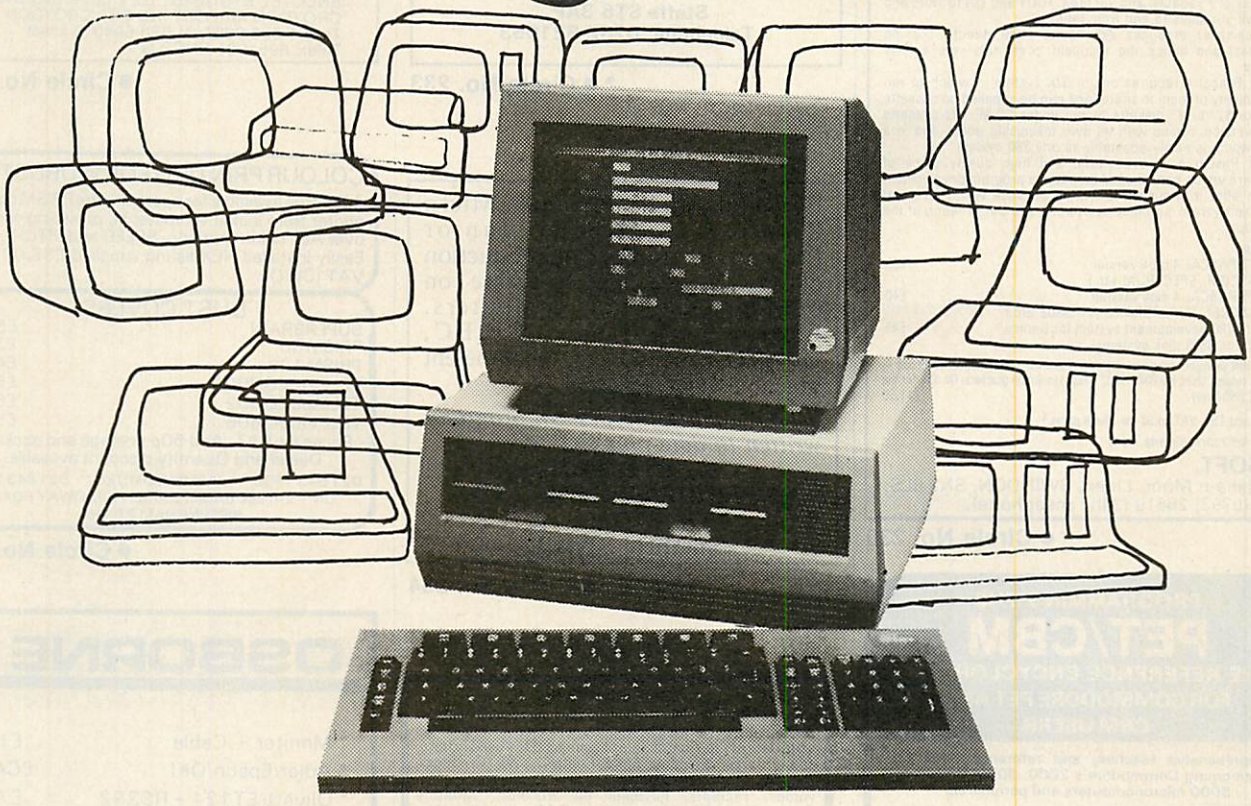

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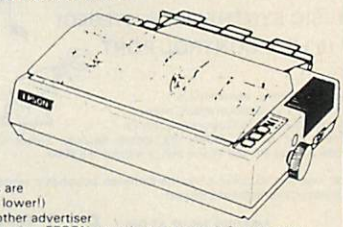

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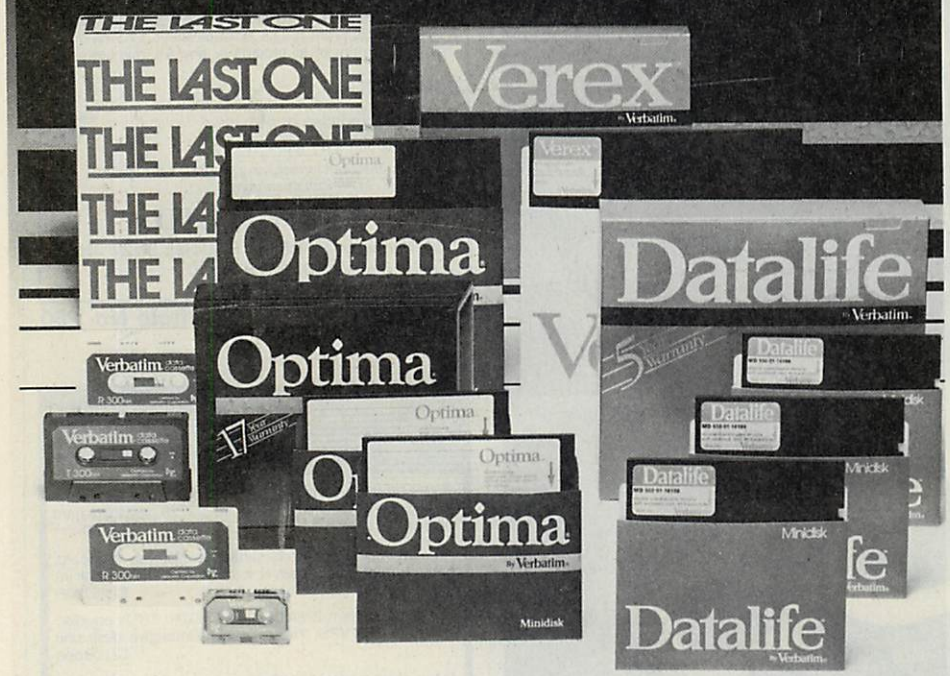

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